'The folly of generalisation': infant mortality in Loughborough, Leicestershire 1888-1910

Thesis

‘The folly of generalisation’: infant mortality in Loughborough, Leicestershire 1888 - 1910

Norma Ann Cattell B.A. (Hons) Open,
L.R.S.M., L.R.A.M.

Doctor of Philosophy degree - 2005

EX12

THE OPEN UNIVERSITY

RESEARCH SCHOOL

Library Authorisation Form

Please return this form to the Research School with the two bound copies of your thesis to be deposited with the University Library. All candidates should complete parts one and two of the form. Part three only applies to PhD candidates.

Part One: Candidates Details

Name: (NORMA) ANN CATTELL PI: ~~OURE50501?~~ M9904739

Degree: PhD

Thesis title: 'THE FOLLY OF GENERALISATION': INFANT MORTALITY IN LOUGHBOROUGH, LEICESTERSHIRE 1888-1910

Part Two: Open University Library Authorisation

I confirm that I am willing for my thesis to be made available to readers by the Open University Library, and that it may be photocopied, subject to the discretion of the Librarian.

Signed: N A Cattell Date: 10 February 2006

Part Three: British Library Authorisation [PhD candidates only]

If you want a copy of your PhD thesis to be available on loan to the British Library Thesis Service as and when it is requested, you must sign a British Library Doctoral Thesis Agreement Form. Please return it to the Research School with this form. The British Library will publicise the details of your thesis and may request a copy on loan from the University Library. Information on the presentation of the thesis is given in the Agreement Form.

Please note the British Library have requested that theses should be printed on one side only to enable them to produce a clear microfilm. The Open University Library sends the fully bound copy of theses to the British Library.

The University has agreed that your participation in the British Library Thesis Service should be voluntary. Please tick either (a) or (b) to indicate your intentions.

☑ I am willing for the Open University to loan the British Library a copy of my thesis.
A signed Agreement Form is attached

☐ I do not wish the Open University to loan the British Library a copy of my thesis.

Signed: N A Cattell Date: 10 February 2006

h:vaxm\word\forms\EX12

ABSTRACT

'The folly of generalisation': infant mortality in Loughborough, Leicestershire 1888 - 1910

In spite of much research, stretching over more than a century and across numerous countries, the rapid and widespread decline of infant mortality in Europe, which began around 1900, remains a conundrum. Here, a new source - the Vaccination Registers - brings a new perspective. The Vaccination Registers are based on copies of Civil Registers of Births and Infant Deaths. By supplying individual level data they enable us to investigate the links between infant mortality and a variety of causal factors at a much lower level of aggregation than has hitherto been possible. This thesis is mainly concerned with how to social class and the urban-rural dichotomy affect infant mortality decline, but other topics, such as housing and income; births outside marriage; multiple births; seasonality of death; and place of birth are also investigated.

The area of enquiry is the Loughborough Sub-registration District and the core period of analysis, the years 1888 – 1910. The thesis begins by describing the intellectual context of the study, followed by a description of the major sources. Prior to two chapters on the major areas of investigation, urban-rural differences and social class, I outline the locational context of the study. Chapter 7 then looks at what the vaccination registers can tell us about various related topics.

Most studies of infant mortality in the period covered by this thesis have been carried out at a relatively high level of aggregation – the country, the county or Registration District. By going behind such aggregates to much smaller areas, such as the community, the street and the

household, this study will show that explanations of the level and direction of infant mortality must acknowledge, not only that no mono-causal explanation is valid, but nor is there a standard set of explanations. Rather, 'every district is a law unto itself. Not by wide, sweeping generalisations but by careful *local* consideration of strictly *local* conditions will, in time, this problem be solved' (Pooler 1918:7:).

Contents

The author wishes to thank the Wellcome Trust for its financial support to the Open University Project. Grateful thanks are also due to Michael Drake for his invaluable guidance, to my external supervisors Pamela Sampson, Eilidh Garrett, Peter Razzell and Chris Galley, and to the staff of the Record Office for Leicester, Leicestershire and Rutland, all of whom were there for me when I needed them. Special thanks go to my family, for putting up with all that producing this thesis entailed.

List of illustrations

I. Figures & Illustrations

Chapter 5

Chapter 6

Chapter 7

Illustration 1
Notice of requirement of vaccination - 1884

9|7|1571|2

The VACCINATION ACTS, 1867 and 1871.

NOTICE OF THE REQUIREMENT OF VACCINATION.

To the Father, or Mother, or Person having the Custody of the Child herein named.

Copy hereunder the No. of the Entry of the Child's Birth from the Register Book	
Entry No.	188

I, the undersigned, hereby give you Notice to have the Child named Lily Cox, whose birth is now registered,

1. Insert Child's name and surname.

vaccinated by a Public Vaccinator or some other Medical Practitioner, pursuant to the provisions of the Vaccination Acts; and that in default of your doing so, you will be liable to the penalties thereby imposed for neglect of those provisions.

These Acts require every child to be Vaccinated before it is three months old, or at the next Public Vaccination held in the District after the child has attained that age. The Vaccination may, however, be postponed by Medical Certificate, if the child be not in a fit state to be Vaccinated.

2. To be filled up by the Registrar.

The following are the attendances for Public Vaccination in your District:—

Times and Places of attendance of _____ Public Vaccinator.

Times.		PLACES.
Days of the Week.	Hours of the Day.	
Each MONDAY in the months of January, April, July, and October	2 o'clock.	at By W. G. PALMER, Esq. At his Surgery, High Street, Loughborough, for Loughborough, Knight Thorpe, and Woodthorpe.
The 2nd, 3rd, & 4th TUESDAYS in the months of April & October.	1 o'clock.	At the National School, Hathern, for Dishley and Hathern.
The 1st, 2nd, & 3rd MONDAYS in April & October.	10 o'clock.	By J. A. WOOD, Esq. his Surgery, Sheepshed, for Sheepshed and Charley
The 2nd, 3rd, & 4th MONDAYS in April & October.	2 o'clock.	At Wm. Atkin's, for Long Whatton
The 2nd, 3rd, & 4th MONDAYS April & October	1 o'clock.	At the Vaccination Station, Belton, for Belton.

Within the Metropolis, the following Vaccinators act under Instructions of the Local Government Board:—

Dr. ROBERT CORY	Tuesday, Thursday	at 2 P.M.	Surrey Chapel, Blackfriars Road.
Mr. W. E. G. PEARSE	Monday, Wednesday	at 1 P.M.	Tottenham Court Chapel, Tott. Court Road.

And Vaccination with Animal-Lymph is performed as under:—

Dr. ROBERT CORY AND Mr. SHIRLEY MURPHY	Tuesday, Thursday	at 10-30 A.M.	95, Lamb's Conduit Street, near Foundling Hospital.

After the vaccination has been performed the child must be inspected by the Vaccinator, in order that, if the operation has been successful, he may fill up and sign the requisite certificate (Form D.). When the vaccination has been performed by a Public Vaccinator, the child must be taken to him for inspection at the appointed hour on the same day in the following week.

THIS PAPER must be produced to the Vaccinator for him to fill up and sign the proper certificate. If he be a Public Vaccinator it will be *his* duty to forward the paper to the Vaccination Officer; but if he be not a Public Vaccinator it will be *your* duty, after the certificate has been duly filled up and signed, to forward this paper to the Vaccination Officer, whose address is written on the back.

Dated this 16th day of June 188[illegible]

(*Signature of Registrar*) Lee

Registrar of Births and Deaths for the Sub-District of LOUGHBOROUGH

In the Superintendent Registrar's District of LOUGHBOROUGH

Illustration 2
Notice of requirement of vaccination - 1901

REGISTRATION OFFICE, No. 5 Pocklington's Walk.
ATTENDANCE—Monday, Tuesday, Wednesday, and Friday, 10 to 12-30 Noon, and 3 to 5-30 p.m.
Thursday, 10 to 12-30 only. Saturday, 10 to 2-30.

The VACCINATION ACTS, 1867 to 1898.

FORM A. NOTICE OF THE REQUIREMENT OF VACCINATION.

To the Father, or Mother, or other Person having the Custody of the Child herein named.

Copy hereunder the No. of the Entry of the Child's Birth from the Register Book.
Entry No. 175

1. I, the undersigned Registrar of Births and Deaths, hereby give you Notice to have the Child named [1] Mabel Florence Chesworth
whose birth is now registered, vaccinated by the Public Vaccinator or some other Medical Practitioner, pursuant to the provisions of the Vaccination Acts, 1867 to 1898.

2. These Acts require every child to be vaccinated before it is six months old. The Vaccination may, however, be postponed by Medical Certificate if the child is not in a fit state to be vaccinated, or if in the opinion of the Public Vaccinator, the condition of the house in which the child resides is such, or there is or has been such a recent prevalence of infectious disease in the district, that the child cannot be safely vaccinated.

3. If you desire the child to be vaccinated by the Public Vaccinator before it is four months old, you should give notice to him in the following or to the like effect:—

To DR. HEWLING[illegible] Spa, HUMBERSTONE ROAD, LEICESTER,
Public Vaccinator of the NORTH EAST District of
the LEICESTER Union.

In accordance with Section 1 (2) of the Vaccination Act, 1898, I hereby request that you will
1. Address of the child. visit [1] _____ for the purpose of
2. Child's name and surname. vaccinating [2] _____ who is now residing at that address.

Dated this _____ day of _____ 190 .

(*Signed*) _____
Parent or other Person having the custody of the said Child.

If you desire it, you can obtain from the Vaccination Officer a copy of this form, with the name and address of the Public Vaccinator. The Public Vaccinator will visit the child's home for the purpose of vaccinating the child not earlier than 9 o'clock in the forenoon [illegible] at such an hour in the afternoon as may at some other time shall have been arranged between him and you.

4. If within a week after the child has attained the age of four months, the Vaccination Officer has not received a certificate of its successful vaccination, or of its insusceptibility to vaccination, or of its having had small-pox, and has not in his possession a valid certificate of postponement of the vaccination of the child, and has not received such a certificate as is hereinafter mentioned in paragraph 6, the Vaccination Officer will give notice to the Public Vaccinator, and the Public Vaccinator will call at the home of the child before the child attains the age of six months and will offer to vaccinate the child with glycerinated calf lymph, or such other lymph as may be issued by the Local Government Board.

5. The Public Vaccinator will give you at least 24 hours' notice of his intention to visit the home of the child as mentioned above in paragraphs 3 and 4; and the visit will, in the absence of any sufficient reason for delay, be made within two weeks after receipt of the notice from you or from the Vaccination Officer, as the case may be. If, when the Public Vaccinator visits the home of the child for the purpose of vaccinating it, or of offering to vaccinate it, you request that the vaccination should be performed with lymph issued by the Local Government Board, the Public Vaccinator will use such lymph.

6. You will be exempt from any penalty under Section 29 or Section 31 of the Vaccination Act, 1867, for not having the child vaccinated, if within four months from the birth of the child you satisfy two justices, or a stipendiary or Metropolitan Police Magistrate, in petty sessions, that you conscientiously believe that vaccination would be prejudicial to the health of the child, and within seven days thereafter deliver to the Vaccination Officer for the district a certificate by such justices or magistrate that they are satisfied accordingly.

7. After the vaccination has been [illegible]d the child must be inspected by the Vaccinator, in order that, if the operation has been successful, he may fill up and sign the requisite certificate.

8. The Vaccinator will give his certificate in one of the annexed forms, and for this purpose *this paper* should be produced to him. If he is a Public Vaccinator it will be *his* duty to forward the paper to the Vaccination Officer; but if he is not a Public Vaccinator it will be *your* duty, after the Certificate has been duly filled up and signed, to forward this paper to the Vaccination Officer, whose name and address are on the back.

Should the child die before Vaccination, please bring this Paper to the Registrar, along with the Medical Certificate of Death.

Dated this 4 day of June 190 1

(*Signature of Registrar*) THOMAS CARTER,

Registrar of Births and Deaths for the Sub-District of North East Leicester,

in the Superintendent Registrar's District of LEICESTER.

W B & L (11os)—2037s—404,000-12-1000

'The folly of generalisation': infant mortality in Loughborough, Leicestershire 1888-1910

Introduction

'...the real principle which must guide us in considering this problem of infant mortality [is] the folly of generalisation. Every district has its own problem to solve; in one it may be housing; in another sanitation; in another poverty and underfeeding; in another overfeeding or improper feeding, carelessness and low morale; and in yet another it may be atmospheric pollution, and in most a combination of some or all of these. Infant mortality is a hydra-headed evil. Every district is a law unto itself. Not by wide sweeping generalisation, but by careful *local*, consideration of strictly *local* conditions, will, in time, this problem be solved' (Pooler 1918:7)[1]

There was little change in the infant mortality rate[2] (IMR) of England and Wales from the beginning of civil registration in 1837 until the end of the nineteenth century (Woods & Shelton 1997:48 Fig.12). There then commenced, early in the twentieth century, a virtually continuous and rapid secular decline that carried on long beyond the period of the present investigation, from an IMR of 146 per thousand births in 1900-02 to one of only five in 2000-02 (National Statistics 2004:55). Many factors have been suggested both for the relative stability of the IMR over the second half of the nineteenth century and for its rapid decline thereafter (Woods *et al* 1988-89). To date, however, there has been no agreement as to the strength of the factors involved, nor as to how and why those factors came to interact in such a way as to maintain both the level of the IMR in the nineteenth century and to bring about such a dramatic and

[1] I am grateful to Dr P Razzell for drawing my attention to this article.

[2] The infant mortality rate is the number of infant deaths per 1,000 live births

lasting change at the start of the twentieth.

Some years ago Woods *et al* (1989:132) proposed that further work on the origins and causes of infant mortality decline in England and Wales should be based on examining long-term changes during the nineteenth century rather than by seeking evidence for dramatic advances during the early twentieth century. I believe this overlooks the potential of the individual level data held in the vaccination registers (see below and Chapter 3), which form the major source for the present study. The focus of the present work, therefore, is on the last decade of the nineteenth and the first decade of the twentieth centuries, when the sharp secular decline in infant mortality in England began. To see just how dramatic that decline was, I will briefly outline the pattern of infant mortality rates from the 16th to the 20th century.

INFANT MORTALITY IN ENGLAND, 1580-1910

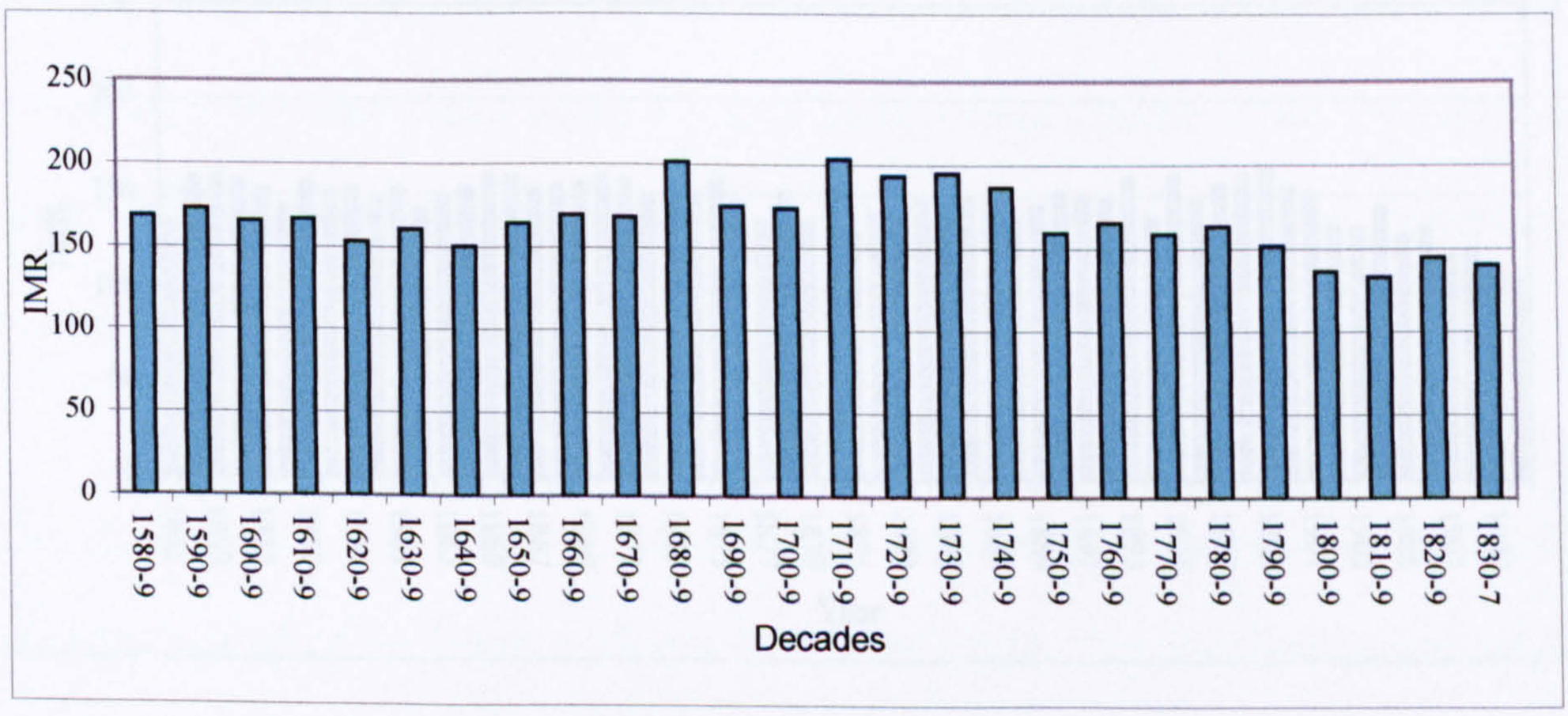


Figure 1.1 Infant mortality rates (deaths per 1,000 births) in England and Wales from reconstituted parishes in the decades 1580-9 to 1830-7.

Source: Derived from Wrigley et al (1997:215 Table 6.1)

Figure 1.1 shows national estimates of infant mortality from the 1580s to the 1830s (Wrigley *et al* 1997). These estimates, however, were based on relatively small

amounts of data from 26 mainly rural English parishes[3], not all of which were in observation for the entire period, and so may not be representative of national trends. Be that as it may, Wrigley *et al's* estimates showed that infant mortality was at its highest from the end of the seventeenth to the middle of the eighteenth century, at least in these more rural areas of England, when it approached and, on occasion, passed the 200 per 1000 mark. By the early 1800s, the rate had dropped to below 150 per 1000 and appears to have been stable at this level until the 1850s when it again rose above 150 per 1000 (Figure 1.2).

Although the overall rates hovered around a mean of 150 deaths per 1,000 births from the 1840s until the twentieth century, beneath these rates there were large geographical variations (a range of 70 to 250 is given by Woods and Shelton 1997:51). Figure 1.2 shows the rates of infant mortality for England and Wales from the middle of the 19th

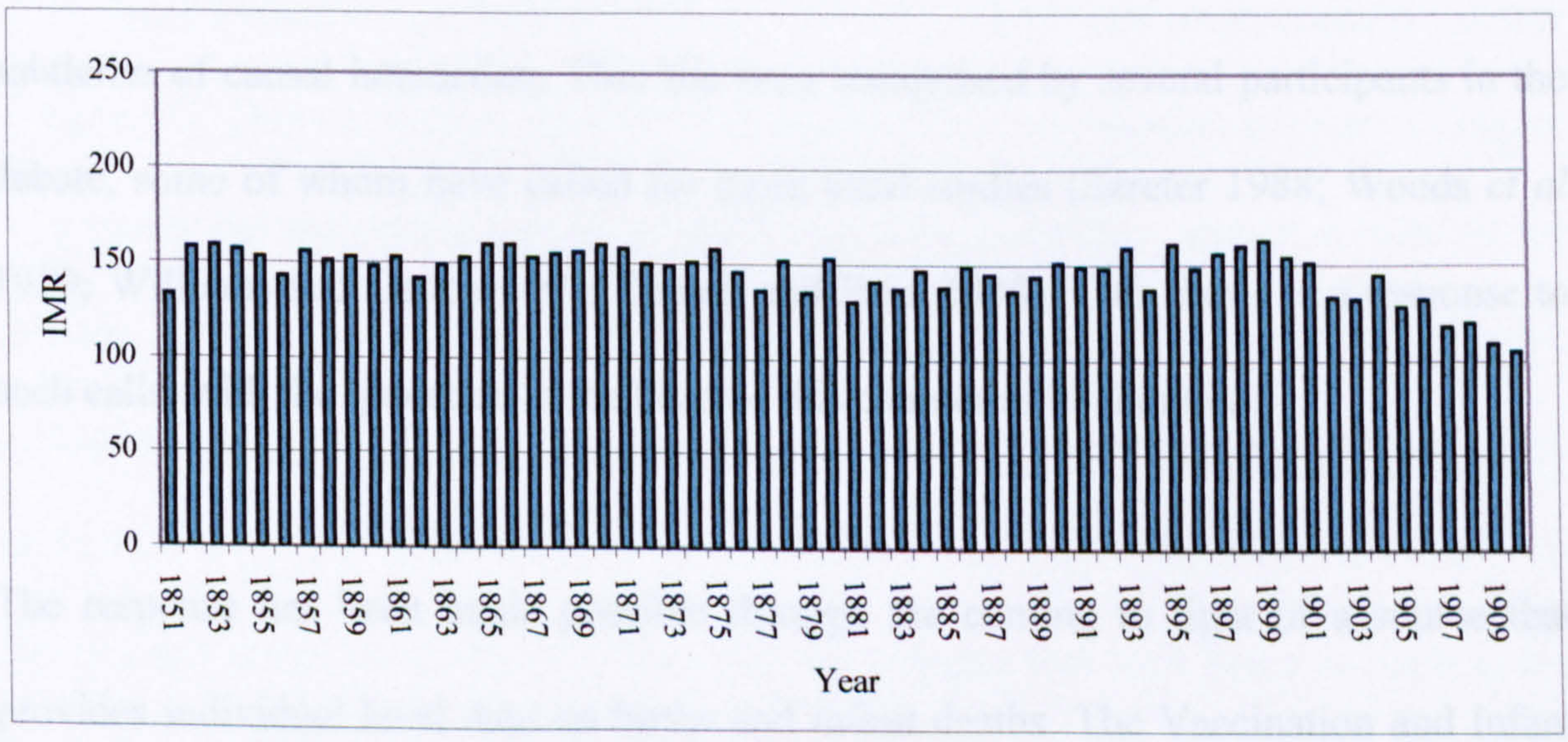


Figure 1.2 Infant mortality rates (deaths per 1,000 births) in England and Wales 1850-1910

Source: Registrar General, Annual Returns.

[3] Although Wrigley *et al* say their study data involves English parishes, their table is headed 'England and Wales' suggesting their data is representative of both countries. In the present study data relates to either England, or to England and Wales, and this should be noted in the event of comparisons being made.

century to the end of the period of this study. The rates clearly rose again in the late 1890s, after a trough in the 1880s. These differences, though, were small compared to the dramatic secular decline that followed from the turn of the century. A drop in the region of 50 deaths per 1,000 births occurred in the first decade of the twentieth century.

In recent years the debate on infant mortality in the period shown in Figure 1.2, has largely depended upon statistics provided by the Registrar General, although in the late nineteenth century when infant mortality[4] first became a matter of concern, there was much speculation based upon local studies carried out principally by the newly created Medical Officers of Health. The problem of working with the Registrar General's statistical data is that it usually comes at relatively high levels of aggregation – the country, county, or registration district. Such entities often embraced a variety of experience - social, economic, political - and as such may well have masked the subtleties of causal interaction. This has been recognised by several participants in the debate, some of whom have called for more local studies (Szreter 1988; Woods *et al* 1989; Williams and Galley 1995; Garrett and Reid 1995). This thesis is a response to such calls, with the quotation at the head of this chapter as its *leitmotiv.*

The response has been made possible through the coming to light of a source that provides individual level data on births and infant deaths. The Vaccination and Infant Death Registers[5] were started in 1872, their purpose to monitor and so help enforce the legislation requiring the compulsory vaccination of all infants against smallpox. The

---

[4] In this study the term 'infant' covers the first year of life; infant mortality concerns deaths up to one year of age.

[5] These should not be confused with vaccinators' registers, which list all vaccinations carried out by the public vaccinator.

two registers are partial copies of the civil registers of births and deaths and, taken together, provide the name, address and date of birth of each child, the name and occupation of the father (or mother where a child was born out of wedlock), the date of vaccination and of death if that occurred under one year of age, together with various pieces of information concerned with the mechanics of the vaccination process. Access to these registers is all the more welcome because the civil registers themselves are effectively closed to researchers. One of the drawbacks of the Infant Death Register, and, it has to be admitted a major one, is that no cause of death is given. Although such information is problematic, its absence is to be regretted. To plug the gap, the annual reports of the local and county Medical Officers of Health have been used to provide insights whenever possible.

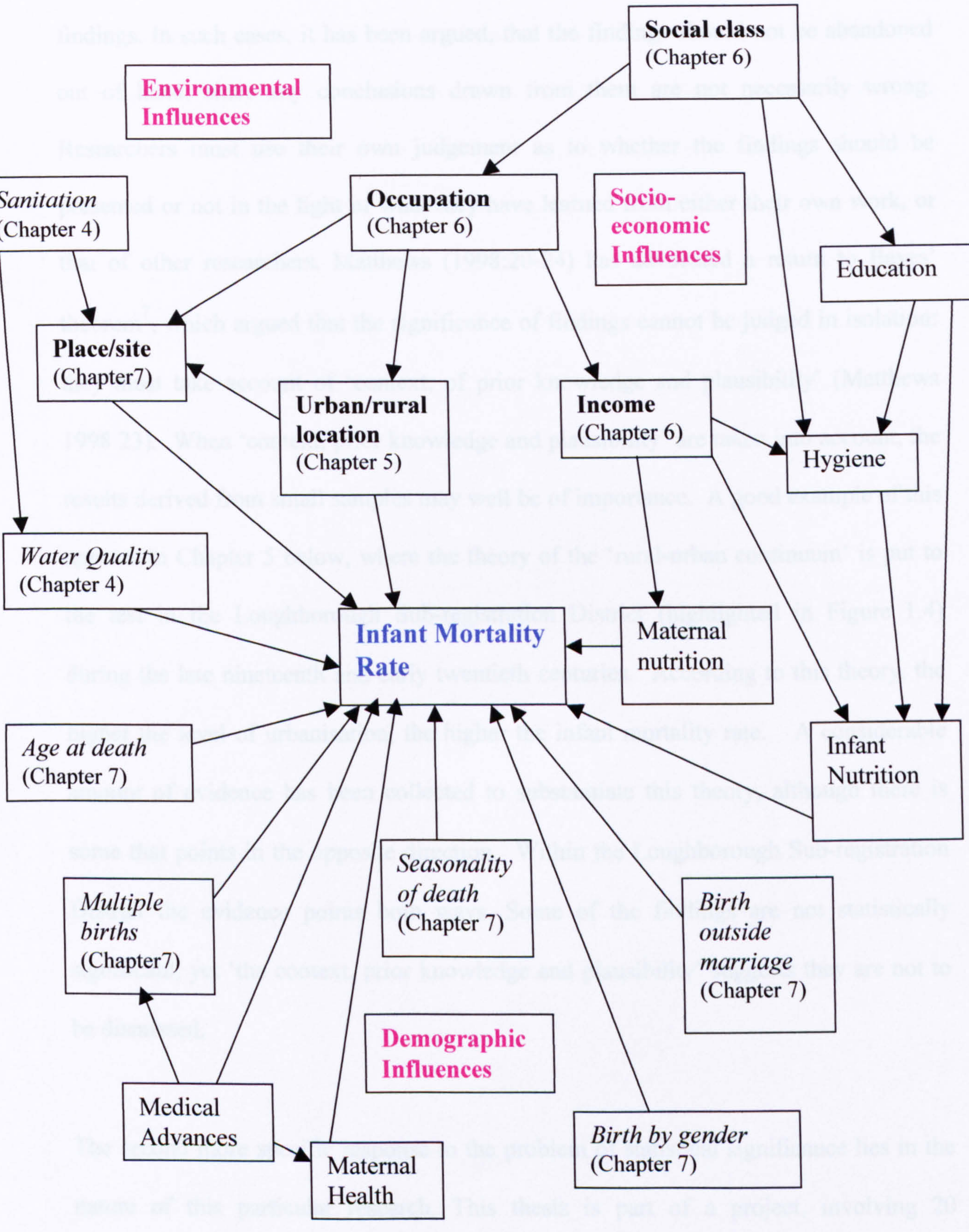
This thesis starts with a literature review that covers the two issues that are at the core of it: infant mortality in relation to the urban-rural gradient and socio-economic status (Chapter 2). There follows a detailed assessment of the vaccination registers (Chapter 3), a source not previously used in research into infant mortality, and an account of the location of the study (Chapter 4), the aim being to provide the socio-economic, geological and demographic contexts for the micro-level studies that follow. This contextual chapter is followed by a consideration of the major diseases and conditions that brought about the death of infants and the changes that took place in these at the time of its rapid secular decline (Chapter 5) within the context of the urban-rural gradient[6]. Armed with the Vaccination and Infant Death Registers, it has been possible to create statistics at a much lower level of aggregation than those provided by the Registrar General. In Chapter 6, the social class aspects of the IMR are examined.

[6] The urban-rural gradient hypothesises that infant mortality rises with the degree of urbanisation.

Seven further issues are discussed in Chapter 7, showing how the vaccination registers can add to our understanding of the mechanics of infant mortality. These are the mortality of infants born outside marriage; the mortality of twins; the seasonality of infant mortality; the relationship between infant mortality and rateable values, used, in this context, as a surrogate for income; infant mortality and the geology of settlement sites; the gender distribution of infant deaths; and the age distribution of infant deaths.

Thus the vaccination registers have allowed me to investigate a wide variety of factors relating to infant mortality: factors that are summarised in the causal loop diagram on the following page. The arrows indicate the main directions of influence. The highlighted factors indicate the major issues I have addressed in this thesis, while italics indicate minor issues that have also been discussed. The boxes give the chapter of the thesis in which a particular aspect of infant mortality is discussed.

One of the problems with the grass roots approach to infant mortality adopted in this thesis is that an inordinate amount of time is required to collect the basic data. Even when infant mortality rates were of the order of 100-200 per 1000 births – horrendous levels by present-day western standards – the exercise is very time consuming. There is too another problem with this approach. For if, as in this thesis, one wishes to operate at relatively low levels of aggregation – local communities, even streets, meaningfully homogeneous groups of people – the problems associated with drawing conclusions from small numbers is ever present. Throughout this thesis instances occur when findings turn out not to be statistically significant. This emerges, of course, only after the data has been collected, rearranged and the calculations carried out! Here, two ways of dealing with the issue are used, one general the other specific.



Key: emboldened influences = major topic; italicised influences = minor topic

Figure 1.3: Various environmental, socio-economic and demographic influences on infant mortality

Source: The author (2005)

The general is applicable to all research resulting in non-statistically significant findings. In such cases, it has been argued, that the findings should not be abandoned out of hand, since any conclusions drawn from them are not necessarily wrong. Researchers must use their own judgement as to whether the findings should be presented or not in the light of what they have learned from either their own work, or that of other researchers. Matthews (1998:20-24) has advocated a return to Bayes' theorem[7], which argued that the significance of findings cannot be judged in isolation: they must take account of 'context, of prior knowledge and plausibility' (Matthews 1998:23). When 'context, prior knowledge and plausibility' are taken into account, the results derived from small samples may well be of importance. A good example of this appears in Chapter 5 below, where the theory of the 'rural-urban continuum' is put to the test in the Loughborough Sub-registration District (highlighted in Figure 1.4) during the late nineteenth and early twentieth centuries. According to this theory, the higher the level of urbanisation, the higher the infant mortality rate. A considerable amount of evidence has been collected to substantiate this theory, although there is some that points in the opposite direction. Within the Loughborough Sub-registration District the evidence points both ways. Some of the findings are not statistically significant, yet 'the context, prior knowledge and plausibility' suggests they are not to be dismissed.

The second more specific response to the problem of statistical significance lies in the nature of this particular research. This thesis is part of a project, involving 20 researchers, carried out under the auspices of an Open University research group: Open Studies in Family and Community History (OSFACH). The project has, in part, been

---

[7] Thomas Bayes published, in 1763, an *Essay toward solving a problem in the doctrine of chances.* While Bayes' theorem is difficult to apply in practice, it does raise the argument that significance testing is not the only proof of valid results.

funded by the Wellcome Trust. Research along the lines of this thesis has been pursued in 20 locations.[8] As a result, the non-statistically significant findings of one study may be enhanced when data is added from another. Care must be taken, however, as much weight is placed in the project on understanding what is specific and what is general about each of the communities in which the research is carried out.

[8] The locations are Ampthill (Bedfordshire); Cholsey (Berkshire); Cambridge; Hollingbourn (Kent); Loughborough (Leicestershire); Norwich; Higham Ferrers (Northamptonshire|); Clun (Shropshire); Ipswich (Suffolk); York; Hemsworth (West Riding of Yorkshire); Sheffield; Colneis (Suffolk); Beccles and Bungay (Suffolk); Nuneaton (Warwickshire); Warwick; Bexley (Kent); Sheffield; Fulham; Bath (Somerset).

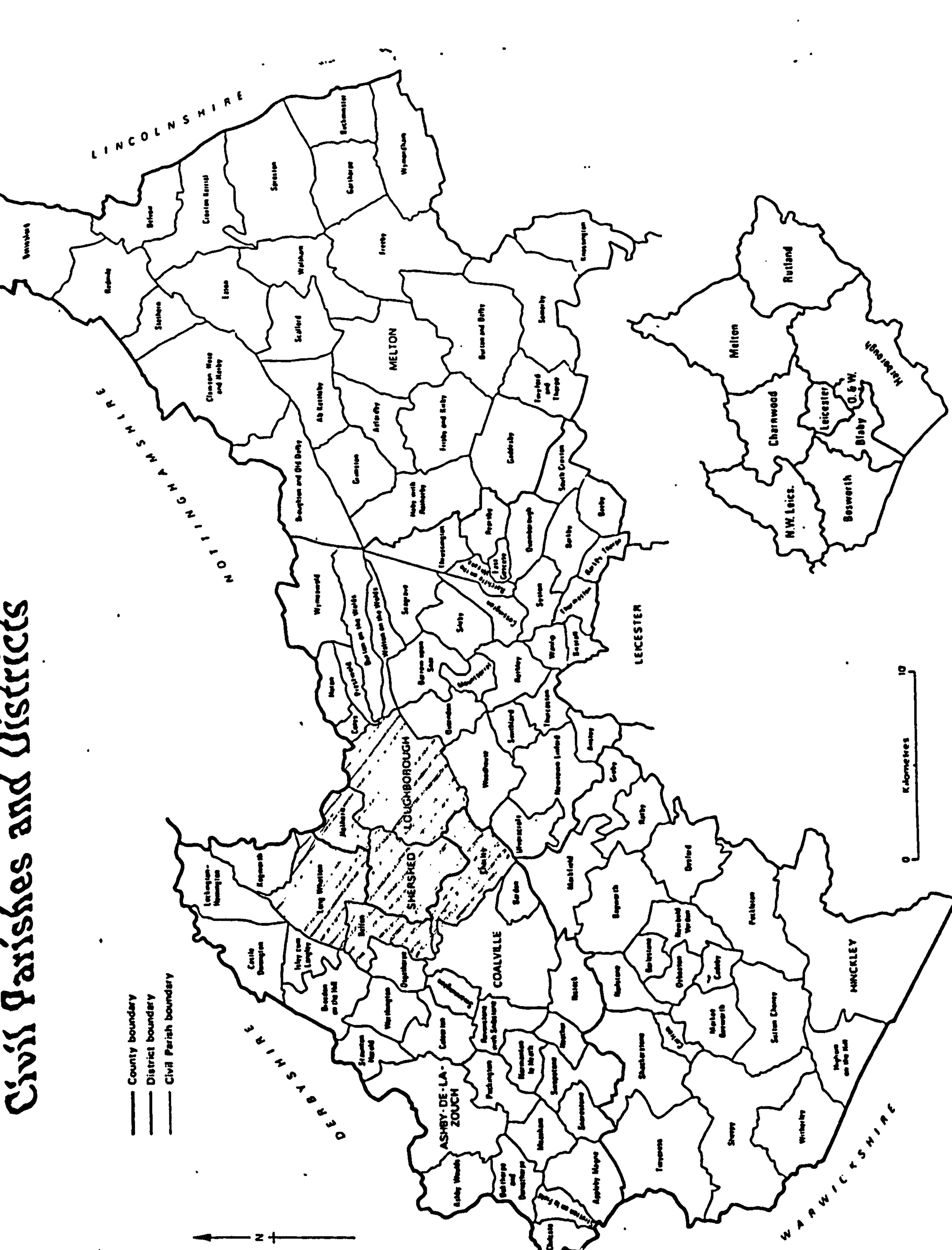


Figure 1.4: Civil Parishes and Districts in the Loughborough Sub-registration District

Source: Strachan, Dr A J, (1986)

2

Two major issues in the history of infant mortality

The penultimate factors generally considered to determine the level of infant mortality are set out in the causal loop diagram given in the introduction to this thesis. They are grouped into three categories. Two are the central issues of this thesis: the environmental and the socio-economic. The emphasis on these two categories is, in part, because they have provided a focus for much of the debate on infant mortality in the late nineteenth and early twentieth centuries and, in part, because the vaccination registers, a core source for this study, provide a good opportunity for advancing the discussion.

Recently, key players in these debates, so far as English experience is concerned, have been Woods *et al* (1988; 1993; 1997) who noted location-related differences in infant mortality and observed the influence of densely populated urban districts on national infant mortality rates; and Garrett *et al* (2001) who used data from the 1911 census to investigate the interactions between environment, social class, and infant/child mortality. Both environment and class impacted on the infant via disease, the proximate cause of death. A section below is, therefore, devoted to earlier thinking on the contribution of various diseases/conditions to infant mortality, so as to provide a context for the later discussion of the situation in the Loughborough Sub-registration District.

THE URBAN-RURAL DICHOTOMY

It has been noted that there were wide variations in the levels of infant mortality within England and Wales during the late nineteenth century (Woods and Shelton 1997). The highest IMRs were to be found in the large industrial conurbations. Rural areas had generally lower rates, although some parts of eastern England and Cornwall had rates that were comparable to those in industrial areas (Woods and Shelton 1997: 49). Woods and Shelton (1997:55) comment on the comparison of the age structure of death and the cause of death within infancy, for three towns and three rural counties in the years 1889-91 undertaken by William Ogle, Farr's successor at the Registrar General's Office. He discovered that whereas death rates within the first week of life were not dissimilar, the gap between the urban and rural areas thereafter increased at each age throughout the rest of the first year. As for the cause of death, the major killers – accounting for approximately three-quarters of all infant deaths in both areas – were notably more powerful in the towns (Table 2.1).

Table 2.1 *Infant mortality rates (deaths per 1,000 births) by cause in three towns (Blackburn, Leicester and Preston) and three rural counties (Dorset, Hertfordshire and Wiltshire) 1889-91*

Cause of death	Urban	Rural
Premature Birth	22.8	13.8
Diarrhoeal diseases	39.6	4.8
Diseases of nervous system	37.8	13.8
Atrophy	27.3	17.4
Respiratory diseases	37.0	21.1
Total	164.5	70.9
All causes	218	97

Source: Woods and Shelton 1997: 54

The work of Ogle focused on large towns, but even small towns had higher rates than their hinterlands (Woods, Williams and Galley 1993: 41). Gardarsdottir (2002) also noted this in her recent review of the impact of the urban and rural environment on

infant mortality across Europe. Whilst the English pattern was evident, there were changes over time. For instance, in Sweden infant mortality in urban areas had shown 'little improvement' from 1830-1880, whilst it had fallen in rural areas. From 1880, however the urban rate began to fall rapidly and had dropped below the rate in the countryside by the 1920s. In large German cities the rate was higher in the towns than in the countryside, although the gap between the two was not as great as in England. From the 1870s, however, the urban IMR in Germany began to fall rapidly whilst showing little improvement in rural areas, and was lower than in the latter by 1900. Furthermore in 'Germany, Austria and Sweden, the downward trend in infant mortality coincided with accelerated urbanisation' (Gardarsdottir 2002: 27). As for Iceland itself, a country with very high infant mortality rates, the towns, though small, had lower rates than the rural areas, largely due to the absence of breastfeeding in the latter (Gardarsdottir 2002: 104).

England, like other European countries, experienced conflicting patterns of mortality decline (Woods *et al* 1993:35-50). On the one hand there was an increase in infant mortality in the 1890s followed by a precipitous decline from 1900, a pattern explained by Woods *et al* (1988:362) as being due to the 'urban-sanitary-diarrhoeal effect'. In other words, this pattern was a result of poor sanitation in densely populated urban areas leading to a high proportion of infant deaths from diarrhoeal illness (see below). There was, too, an underlying downward trend from causes other than diarrhoea that originated in the mid-1870s and had a final peak in 1891, followed by a gradual decline. Woods *et al* (1988:362) proposed that the first trend explained Britain's aberrant pattern compared to other western European countries, and that the rapidity of the decline early in the twentieth century came about because the two downward trends

came together at that time.

Whilst there is general agreement that the higher IMRs in towns than in rural areas prior to water and sewage systems being in place, was because infants in towns suffered disproportionately from water and food-borne diseases, paradoxically the development of those systems did not always bring a fall in their incidence. Thus in Germany, central water and sewage systems were put in place and by 1900 no town with more than 2500 inhabitants was without the former. Yet by the end of the nineteenth century more infants were dying from diarrhoea than in 1870 (Vogele 1997 cited in Gardarsdottir 2002: 29). The same seems to have occurred in England, where investment in water systems, the primary target of local authority investment, does not seem to have reaped early dividends so far as infant mortality was concerned, as Bell and Millward noted (1988:22):

> investments in water supply were generally undertaken without regard for the disposal of resulting wastes...it is unlikely that significant environmental improvement would have occurred as a result of sanitary investment before expenditure on the complementary services of paving and sewerage had sufficiently nullified the consequences of misguided early investment in water.

The main conclusion to be drawn from this review is that whereas the general presumption that urban IMRs were higher than rural ones is well supported, there were sufficient exceptions from this to warrant further enquiry.

It is apparent from Table 2.1 that different diseases/conditions accounted for different levels of mortality in rural and urban settings. To see how this might have come about, we shall look at the principal categories.

Developmental and wasting conditions including prematurity

Just after the core period of this study, in 1914, Brend (1917:19) analysed infant deaths by cause. He compared the situation in England and Wales as a whole with northern county boroughs, southern rural districts and northern Scotland. In all areas the category of 'developmental and wasting conditions including prematurity' was responsible for the greatest number of deaths. The county boroughs of the north also experienced high infant mortality from respiratory diseases and from diarrhoea and enteritis, but in the rural districts of the South and in Northern Scotland, there were fewer respiratory deaths and deaths from the category 'other diseases', while diarrhoeal deaths were no more frequent than deaths from pneumonia.

In the 1900s, working-class women who married in their teens or early twenties faced an average of ten pregnancies. Of these, around three would end in miscarriage, two in death during birth or infancy, and only five would survive into childhood (Humphries and Gordon 1993:5). Although middle-class women generally had fewer children, they also lost many babies either during pregnancy and childbirth, or within the first twelve months. A letter collected by the Women's Co-operative Guild in 1915 illustrates this enormous loss of life:

> My grandmother had over twenty children; only eight lived to about fourteen years, only two to a good old age. A cousin (a beautiful girl) had seven children in about seven years; the first five died in birth, the sixth lived, and the seventh died and the mother also...Another had seven children, dreadful confinements, two or three miscarriages...three children died and the mother also quite young (Gray 1990:54).

There are two main types of early age deaths (primarily neo-natal). One was of infants born before the full term of pregnancy had elapsed and who were not sufficiently formed to survive outside the womb. The other was of children born with injuries or genetic problems, who were also unlikely to survive. Various terms were used in the classification of these deaths. Atrophy was a wasting of part of the body, often apparent

at birth and sometimes called 'marasmus'. Debility was a failure to thrive that could be affected by the general health of the family and the environment in which the child lived. Convulsions were nervous spasms that could be brought about by diarrhoea, diphtheria, and such zymotic diseases as scarlet fever and measles. Newman (1906:60) suggested almost half (48 per cent) of infant deaths in towns occurred in the first three months of life, chiefly from 'immaturity'.

Armstrong (1986:224) claimed that the apparent reduction in wasting diseases between 1881 and 1931 was the result of the re-classification of deaths from atrophy, debility, and marasmus to premature births, which increased commensurately. In 1907, he says, a notion arose that first-week deaths from immaturity and debility should be 'hardly regarded as viable' and premature births could be disregarded because they represented 'an attribute of the mother who had produced such a birth'. This dismissal of early deaths is surprising because infanticide had become a matter of public scandal from the mid-nineteenth century (Langer 1974:360-1). In England, in 1872, the Infant Life Protection Act sought to prevent 'the destruction of the lives of infants put out to nurse for hire by their parents', by enforcing the compulsory licensing of so-called baby farms[1].

Stillbirths were not compulsorily registered until July 1927, much later than the period of this study. Mooney's (1994b) paper describes the difficulty of assessing just how many stillbirths were in reality concealed live births outside marriage or deaths

---

[1] Jones (1894:43) calculated, using the Registrar General's data from 1863 – 1887, that 61 per cent of deaths from homicide were under the age of one year. Large numbers of these deaths were due to overlaying, and the correlation between the highest numbers of apprehensions for drunkenness on Saturdays, and the majority of infant deaths from suffocation being recorded on Sundays, was striking (Jones 1894:41), although data from a control group of tee-total parents could have increased the validity of Jones' analysis.

deliberately misrepresented, either for the sake of economy, since the burial of a still born child was much cheaper, or for criminal purposes. At the start of stillbirth registration, the national rate was 40 per 1,000 births (Mooney 1994b:45). Before that, stillbirths were treated as neither a birth nor a death and so not covered by civil registration. The proportion of unregistered deaths is, therefore, unknown, leaving the situation throughout the nineteenth century unclear. Mooney (1994b) found that estimating the effect of stillbirths to arrive at a truer IMR could sometimes make substantial differences to the rate calculated from registered births and deaths, especially in the provincial towns.

Bronchitis and Pneumonia

Bronchitis is an inflammation of the airways to the lungs, mainly of viral or bacterial origin, but also by other causative agents including fungi and parasites. The infection causes excessive mucus production and a narrowing of the upper respiratory tract. If untreated it may lead to pneumonia, an inflammation of some of the alveoli (air sacs) in the lungs. To fight the infection, the alveoli fill with white blood cells and this inhibits oxygen absorption by the lungs. Pneumonia can be a very grave complication of measles in malnourished children and in children up to one year of age (Terrero *et al:*1992).

In an earlier period, 1670-1830, Landers (1993:160), in his work on the demographic history of London, found that it was a reduction of mortality in the first three months of life that influenced the long-term decline. He suggested it was unlikely to have been gastric diseases that were wholly responsible, because:

> there is evidence of deaths from respiratory infections in the three to five month age group before 1750 and, though we have not been able to establish this definitively, it is probable that

these also took their toll among younger infants during the earlier part of the period.

While Douglas (1950) argued that bottle-fed babies were more liable to lower respiratory diseases, bronchitis, and pneumonia, during the first nine months, Jones (1894:12) believed that bronchitis and pneumonia often followed another ailment, such as summer diarrhoea or atrophy/debility, and that many organic diseases of the heart, lungs, and kidneys dated from an attack of a communicable disease. During the core period of this study, previous illness was not recorded on the death certificate, so the given cause of death may, in reality, be a secondary cause. This may be the reason why communicable diseases do not appear to be significantly represented as a cause of infant mortality. Smith says:

> declines in the incidence and case fatality of scarlet fever, smallpox, cholera, tuberculosis, typhoid fever, do not primarily relate to infants, for none of these was a consistent leading destroyer of life under twelve months (Smith 1979:113)

A summary of the literature shows that respiratory disease is worsened by damp and cold. Brunekreef *et al* (1989) found a strong association between measures of home dampness and both respiratory symptoms and other non-chest illness in children aged eight to twelve in six cities of the United States. Koskinen *et al*'s (1999) study of Finland found building-related moisture or mould increased the risk of upper and lower respiratory infections and symptoms as well as of non-respiratory symptoms in adults. In Britain, there is a marked rise in all-age deaths from respiratory disease during cold winter months (Langford *et al*:1995, Douglas *et al:*1996). Low post-winter levels of vitamin D and exposure to mould are postulated as two possible causal mechanisms. Ayres (1986) found that, in general practice in the United Kingdom, acute bronchitis had an appreciable variation from a peak in January to a trough in August, with attack rates highest in the extremes of life. Anderson *et al's* (1990) study supports the idea that respiratory syncytial virus is a major contributor to winter peaks in lower respiratory infection death of infants aged from one to eleven months, and confirms Murphy's

(1980) earlier study in Melbourne, Australia. The para-influenza viruses follow different patterns. These modern studies indicate that infants would be more susceptible to respiratory infections when living in cold, damp atmospheric conditions. The high cost of fuel compared to income would have made it difficult to keep slum dwellings warm and dry.

Earlier studies investigated the level of air-pollution, which may not only have been a contributory factor to this category of deaths, but to the urban-rural dichotomy and to infant mortality in general. Crowther and Reynolds (1897:602) made the following observations: The centre of Leeds received 10,140 hours of sunshine in the decade 1887-1896, a quarter of a mile west of the city centre that figure increased to 12,250 hours, whilst the village of Adel, 4 miles west of the city centre received 13,512 hours. That average gap of some 300 hours between the centre of Leeds and its outskirts prevailed in relatively sunny years. But in years when there was relatively little sunshine, the gap often widened, although not invariably. Thus, in 1889, when the centre of Leeds received only 720 hours of sunshine i.e. two hours a day, Adel received 1131 hours i.e. three hours a day. In the Soar Valley basin, where the Loughborough Sub-registration District is situated, the atmosphere suffers from high humidity levels even in the summer. However, the wide variations in infant mortality experienced by adjacent areas do not indicate that the weather alone could account for the differences.

While not necessarily fatal, damp living conditions and associated high fungal levels may have had an adverse effect on the survival rates of infants suffering from other ailments. This suggests that an historical comparison of the levels of infant deaths from respiratory illness in damp and dry areas could prove worthwhile.

Diarrhoeal diseases

> Low infantile vitality, resulting from too early marriages, chiefly among the artisan and working classes, whose social and sanitary habits...are highly unfavourable to the growth and development of their too numerous progeny...is the *chief* factor in the causation of a high national infantile mortality...This...makes one almost wish for the good old times, when the children sported on the village green and the British workman revelled in his cottage home with his chubby boy on his knee, after a day of healthy toil in the harvest field or in the meadow (Weir, 1878)

An idealised image of rural life is often depicted in Victorian art and literature, yet there is no doubt that urban infants had, in the main, higher death rates than rural ones and suffered far more from infantile, or summer, diarrhoea. Diarrhoeal illness produced annual clusters of infant fatalities in the summer months. In Leicester, Weaver (1871:5) observed that

> diarrhoeal epidemics occur yearly, and at much about the same periods within certain limits. Generally, however, these attacks are preceded by, or accompanied with other diseases of the same order – such as Small-pox, Measles, or Scarlatina. And especially during last summer and autumn, the inhabitants suffered severely from a double attack of Diarrhoea and Scarlatina.

One nineteenth-century description (Notes:6 anon) of atrophy, classified in MOH Reports with other wasting conditions and grouped with congenital malformations and premature births, is so similar to diarrhoea that previous research into these deaths may not have taken into account the full number of cases.

Diarrhoeal illness, we now know, is caused by one of several germs entering the digestive tract of the sufferer, either through food or drink, or through poor personal hygiene. Germs can enter the food chain at any point from its source to its consumption, either through lack of cleanliness or by a vector such as the common housefly. All babies were at risk when, to ease their pain of teething, the mother rubbed her infant's gums with dirty fingers. Other risks were unclean clothing, flies contaminating food and dummies, which, as Newman (1906:247) pointed out, 'fall on the floor... [and]...they are never cleaned except, perhaps, on a dirty apron'.

The milk supply

Dr Turner (LeMOH: 1874-79), in his Medical Officer of Health's Report for Leicester in 1876, attributed summer diarrhoea to artificial feeding but Weir (1878:20-21) dismissed this suggestion, arguing that 'the breast milk of an unhealthy or improperly fed mother is even more inimical to the health of a child than well-selected and well-cooked artificial food', irrespective of the town's state of cleanliness. Weir may have a point, but Wohl's (1983:21) observation that 'feeding infants with human milk reduces the incidence of gastro-intestinal infections' is well researched. Breast-feeding prevents neo-natal and post neo-natal illnesses because maternal antibodies give some immunity for babies up to six months of age. The infants of working mothers were more prone to diarrhoeal infections because they were more likely to be bottle-fed, risking the use of poor substitutes for the mother's milk, heat, humidity[2] and lack of hygiene. The long tubes attached to the babies' milk-bottles were often a source of disease. According to Langer (1974:361), babies in care commonly died through being given improper or insufficient food, opiates, drugs, etc. In many baby farms they were kept in crowded rooms and suffered from a want of cleanliness or even wilful neglect, which resulted in diarrhoea, convulsions and wasting away.

Sloane (c1876:17) suggested that 'infantile diarrhoea [was] caused by children being fed with milk from cows which drink water contaminated by sewage.' He found the wards in Leicester with the highest infant mortality from diarrhoea were supplied with milk from cows feeding in a district below the town adjoining a stream contaminated with sewage. He mentions his own success in forbidding the use of cows' milk in

---

[2] Leicester does...suffer a peculiarly humid atmosphere in the summer months which may be explained by its situation in the valley of the river Soar, with the Charnwood Hills on one side and the East Leicestershire uplands to the other (McCleary 1905:92). Loughborough was also situated in the valley.

treating children with diarrhoea, condensed milk being given instead. [The better keeping qualities of condensed milk were not considered, neither was the quality of the water supply in the area.] Tabes mesenterica [abdominal tuberculosis] occurred most frequently in infancy. Jones (1894:27) reported between two and fifty per cent of stall-fed cattle were tubercular, and that the tubercle bacilli had been found in the milk of tuberculous cows. At the turn of the century, the focus in the Leicestershire County MOH Reports moved from infantile diarrhoea to tubercular illness. Elliott (1979:91) suggested that one of the contributory factors in the decline of infant mortality was the improvement in the quality of milk sold at the end of the nineteenth century, a result of both systematic sampling by public analysts and action by magistrates against those found guilty of adulterating milk. Smith (1979:114) noted

> the practice of boiling milk spread among working-class families after 1900 and the Board of Agriculture instituted minimum legal standards for the quality of milk in 1901.

These changes no doubt reduced the numbers and/or the severity of diarrhoeal attacks for infants and this date coincides with the start of the substantial decline in infant mortality in England and Wales as a whole. However, this benefit could only affect those families that consumed cow's milk, and, as Smith (1979:114) stated,

> families did not buy milk in worthwhile quantities unless the breadwinner brought home at least 30 shillings per week.

Findlay (1917:37) argued that the evidence from the towns that had inaugurated milk depots did not suggest they were of much value in decreasing infant mortality. The national decline from the year 1901, seen in aggregate figures, occurred before milk depots were operating throughout the country.

Water supply and sanitary reform

Water contamination would decrease with increased distance from the city centre through the natural self-cleansing process of moving water. Sloane (c.1876) found a

difference between deaths in the centre and outskirts of Leicester to support this. Using figures from Sloane's Report, I found the relationship between rainfall and diarrhoeal mortality in Leicester was not marked when only *infant* deaths were measured. However, the fact that, for many people, all water had to be brought into the home from a pump in the street did not make cleanliness easy to achieve. Also, the water that was available might well be contaminated from various sources, such as the drainage from stables and public urinals, the run-off from slaughterhouses, or inadequate sewerage. Cesspits and wells were often too close to each other for the water supply to remain uncontaminated.

Table 2.2 *Infant deaths 'On results of works, etc, for promoting Public Health' in Leicester* [3]

Deaths per 10,000 Population, Under 1 Year	Before any Sanitary Works 1845-51 (7 years)	During construction of main sewer works and supplying water 1852-5 (4 years)	During construction of 30 miles of sewer in the town 1856-61 (6 years)	Since completion of public sanitary works 1862-4 (3 years)
All Causes	80.25	79.00	74.50	81.00
Male	44.30	43.30	41.80	45.70
Females	35.90	35.70	32.70	35.20

Source: Buchanan, (1866:77) in Ninth Report of the Medical Officer of the Privy Council, Appendix 2.

Buchanan (1866:79) analysed infant deaths during an early period of sanitary improvements in Leicester in the 1850s (Table 2.2). Buchanan's (1866:78) study indicates that expenditure on sanitary works in this area *at that date* was not effective in reducing infant deaths:

> Infantile deaths (from all cases under one year) were lowest in the third period, but even then were higher than in any town into which these inquiries has been carried. In the three years, 1862-4, they have returned to the same proportionate number as in earlier years [1845-51].

In some diseases, mortality at all ages fell somewhat over the twenty years of

Buchanan's analysis, but diarrhoeal deaths for the under five age group were actually higher *after* the public sanitary works were completed, although not as high as the period during which the main sewers were being constructed. Deaths from scarlatina and lung disease were also higher in the under-five year age group in the 1860s than earlier. What Buchanan's report does not tell us is how long it took for domestic connections to be made. This could have influenced the lack of change in infant mortality. The return of epidemics of infantile diarrhoea in the late 1890s, attributable to a series of long, hot summers, challenged public opinion as to the cost effectiveness of expenditure on sanitation. In their sample of 36 towns, Bell and Millward (1988:13) found the years 1901-1905

> marked the peak of investment...[in municipal sanitary reform]...after which there was an equally general decline in the annual rate of expenditure on all functions.

Armstrong (1986:224) noted a move, made by the Registrar General in 1911, to omit diarrhoeal deaths from the IMR. Summer diarrhoea was relegated to the status of an anomaly, because its fluctuations with the weather confused the real trends in infant mortality. Increased mortality had occurred throughout the country in the late 1890s and again in the year 1911, which was believed to be due to the hot summer weather. In Leicester, Sloane (1876:9) had dismissed heat as a factor in infant mortality as early as 1876, but theorised there was a possible causal relationship between rainfall and mortality, since

> in a wet season the sewage is more freely washed out of the sewers...[also]...when there is a copious rainfall in Leicester, the pumping engines are not sufficiently numerous and powerful to pump all the liquid that comes out of the sewers, the floodgates have to be opened and the sewage passes into the river without having been subjected to the purifying process (Sloane 1876:13).

In any case, fluctuation is not in itself a valid argument for ignoring a cause of death

---

[3] These figures should not be confused with IMRs, which are calculated using total births.

since the levels of other causes, for example epidemics or respiratory problems in bad weather, are also capricious. Cyclical variations in epidemics occurred naturally due to the lessening resistance of the population as new generations were born without immunity.

Hygiene

Newman (1906:144-49), after describing scientific investigations into the troublesome bacteria that caused diarrhoea, stated that there was insufficient knowledge to reach a conclusion. However, at the same time, according to Guha (1993:397), writing on the health of the British army in India, the knowledge of hygiene was soon to improve generally.

> The lessons in hygiene probably percolated to the domestic environment; 1906, when the health of the soldiers began to improve, also saw the beginning of a drop in infant deaths ascribed to dysentery and diarrhoea.

Guha (1993:394) believed a shift in emphasis from macro-sanitation (public health measures) to micro-sanitation (personal hygiene) was the result of the discovery, early in the twentieth century, that faecal matter could be retained upon the hands of persons dependent on toilet paper for cleansing the anus. However, increased personal hygiene was also suggested by Peters' (1910) study of epidemic diarrhoea which found increased cases of diarrhoea in homes with infants, and this had previously been observed in the clinical investigations of four ward epidemics in New York in the summer of 1903 (Flexner & Holt 1904:189). This had drawn attention to the necessity for disinfection and the closest attention [to hygiene] to prevent contamination of food or water by persons handling the child's napkins, and led to the policy of the Babies Hospital in New York, whereby the nurse in charge of the children's napkins did not having anything to do with their food or feeding, being recommended for all institutions. In 1910, Peters (1910:656) wrote:

the question of dirtiness might be held to be wholly a question of carelessness in avoiding contamination from, and in removing the traces of, specific faecal pollution...attention being at once directed to the constant faecal pollution of the floors [by infants and children] and atmosphere of living rooms, and to the frequent exposure of soiled napkins.

Woodwark (1938:907), speaking retrospectively from the 1930s, claimed that:

some 20 to 30 years ago it was believed that hot weather necessarily meant an increase in the mortality rate of infants aged up to two years. This belief was supported by the actual death rates, since [in] 1911, one of the hottest years of the century, the infant mortality rate was 130, compared with 108 in 1910 and 95 in 1912; but the rates recorded for 1921 and 1933, both of which years had hot summers, did not differ very greatly from the years preceding and following them. In other words, those factors which led to a high infant mortality rate in hot weather some 50 years ago are not operative to-day; and it is a matter of common agreement that improved housing, domestic and personal cleanliness, increased attention to sanitation, public cleansing, disposal of refuse, storage and preparation of food, and the relative freedom from dust of public thoroughfares, due to the alteration of the road surface, have all contributed to the result.

Whatever the reason, the number of infant deaths from diarrhoea did eventually decrease, and continued to do so after the core period covered by this study. Woodwark's table of causes of death (1938:910) shows that diarrhoea and dysentery fell by over two-thirds from its level in the period 1911-1914 to the period 1920-25, for those aged one to five years. The biggest reductions in infant mortality in the following six years, from 1926-1932, were from inflammation of the stomach and bronchitis.

SOCIAL CLASS

Recently it has been argued that 'who one was' had a greater impact on a child's health than 'where the family stayed' (Garrett *et al* 2001). This is a complex issue as the former factor (the socio-economic group) and the latter (the social and physical environment) are closely linked. For instance, manual labourers were often drawn to a particular area by the price of housing and its proximity to the workplace. Thus Garrett and Reid (1995:98) observed that:

children of the lower classes suffered disproportionately because they were more likely to live in noxious environments, *not* because they were born into the lower social orders. Middle-class

children were not immune to the pests of industrial life, but they were much less likely to live with parents who had made their home next to a factory, a mine or a potbank[4].

Garrett *et al* (2001: 146) concluded that in the late nineteenth and early twentieth centuries the surroundings in which people lived appeared to have been much more important with regard to the risks of infant and child mortality than was their social class as measured by the Registrar General. This suggested the distribution of classes over environments[5] rather than the concentration of classes within environments exacerbated environmental differences. Garrett *et al* (2001:122) also found differences in the health of infants according to the parents' origins that might have been related to childcare practices and economic circumstances.

Breastfeeding

The 'childcare practice' that has attracted the most attention is that of breastfeeding. Woods (2000:383) has suggested that the different patterns of infant mortality between European countries in the nineteenth century were due to variations in the practice of

---

[4] The importance of place was noted as early as 1875, when two medical doctors, W E Buck and G C Franklin, completed a detailed report on 238 fatal cases of diarrhoea in children under five years of age, of which 186 cases were one year or under. These had occurred in the third quarter of the year, between 1st July 1875 and 30th September 1875, in the Borough of Leicester. They discounted many factors and reported that 'the houses in which the fatal cases occur are not in themselves insanitary as regards size and number of rooms, water supply, ventilation and space, house drainage, closet accommodation' (Buck and Franklin 1875:46). Buck and Franklin's (1875:46-47) early study suggests that place was more important to infant mortality than the people living there, for in Leicester they found infantile diarrhoea was 'not diffused equally through the town,' the disease being most prevalent where the soil was water-logged, the sewers liable to be blocked up and the houses were built on undrained "made ground". Buck and Franklin do not say what sort of families lived in these conditions but it is reasonable to assume they would be of the lower social classes.

The doctors found diarrhoeal disease was almost absent in those parts of the town where these conditions did not exist and suggested that, in order to mitigate the disease:

i) - the subsoil should be efficiently drained of its superfluous water
ii) - a free outfall should be found for the sewers of the town
iii) - clay-pits or other excavations should not be filled up with filthy ash-bin refuse and then built upon.

The Soar Valley drainage scheme, completed by Leicester Corporation in 1891, formed part of a response to these problems.

[5] The environments were defined by the profile of occupations of those living in the area.

breastfeeding, a theory first enunciated in the late nineteenth century (Jones 1894:56-7). The highest IMRs in Europe – and possibly in the world – were to be found in nineteenth century Iceland, where the notion of breastfeeding was 'imported' from Denmark. But as Danish influence was restricted to the towns, notably Reykjavik, infant mortality rates remained high in the countryside. In southern Germany infants were either not breastfed or breastfed and weaned very early, with similar consequences. The lowest IMRs (100-130 per 1000 births) were in Sweden and Norway where nearly every child was nursed by its own mother. The issue is, however, a complex one. For instance, in northern France, infants were breastfed, but by wet-nurses rather than their own mothers. And here both infant mortality and fertility was higher than in England. Williams (1992:91) was unable to conclude whether or not factors such as inappropriate feeding practices or the lack of breastfeeding accounted for a class gap in the pattern of infant mortality between socio-economic groups, while Huck (1997:368-386) has more recently suggested that just a small adjustment in the levels of women *unable* to breastfeed was enough to make a significant difference to levels of infant mortality:

> the relatively small proportion of infants who were not breast fed had a disproportionate effect on the overall mortality rate. This means that significant mortality trends and differentials may be the result of developments affecting a relative small part of the population....and a small change in feeding habits could have had a powerful effect on death seasonality (Huck 1997:381-2).

This is apparent from the findings presented in Table 2.3 below. The table presents a comparison of the infant mortality rates for Huck's two London Boroughs, towns studied by Fildes and Nolan's study of Derby. [N.B. As the data on breastfeeding was taken from individual studies the parameters for each study may be different.[6]]

---

[6] Huck (1997:381) noted the method of feeding in Poplar was recorded during the first six months of life, while in Kensington it was recorded during the first month. Fildes' data covered the first few weeks of life. Nolan (1982) does not say how long breastfeeding continued for her data, although it is likely to have been at least three months.

Allowance must be made for the fact that the data is not strictly comparable, but information on feeding methods is relatively scarce. All the studies clearly showed that breastfed infants had a much greater chance of survival, and any supplementary feeding considerably reduced those chances. Drake (unpub:14) believes the issue of breast feeding would benefit from a community by community investigation. Unfortunately, little direct information on breastfeeding has been located for the Loughborough Sub-registration District.

Table 2.3 *Infant mortality rates by method of feeding: Huck's two London Boroughs, Filde's relevant towns and Nolan's Derby study*

	Breast Only	**Breast plus other foods**	**Other Foods Only**	**Total**
I				
1908-1918				
Poplar	70.9	133.9	307.5	91.7
Kensington	51.6	494.7	496.1	95.4
II				
1902-13				
Salford	104	196	343	*
1906-15				
Cambridge	20	59	94	*
1904-07				
Willesden	129	319	616	*
1908,1910				
Birmingham	152	273	310	*
*Note: the total IMRs are omitted from this group – the data is not given by Fildes				
IIII				
1901-1910				
Derby Total	71	106	217	104

Source: Section I is taken from Huck (1997:381 Table 4 Panel II);
Section II is taken from Fildes (1998:263 Table 4), selecting those towns having data in years related to the present study;
Section III is taken from Nolan (1982:196 Table 19)

Proprietary feeds & working mothers

The educational versus promotional intentions behind a contemporary 'educational'

sales brochure[7] (see Figure 2.1 below) promoting infant foods, which named improper feeding as the most important cause of infant mortality, cannot be quantified. The Allen and Hanbury advertising/information booklet alleged that one reason for the higher levels of infant mortality in industrial than in agricultural areas was due to more mothers working outside the home in the former, making it more difficult for them to breast feed. This view was widely accepted in the late nineteenth century, although research both then and since has thrown doubt on it.

> Physicians attached to hospitals for children clearly realise and strongly emphasise the dangers of an impure milk supply...The Registrar General's tables show that a large proportion of the mortality among infants under one year old is due to diarrhoea and kindred disorders. Closer inquiry reveals that this death-rate from diarrhoea is higher (1) in towns than in the country, (2) in hot weather than in cold, (3) in industrial districts (where the women go to the factories, and hence cannot nurse their children) than in agricultural districts. Of course there are other factors to consider, such as general neglect, unsanitary surroundings, and dirty bottles and utensils; but the most important factor in the case of children under one year is improper feeding. This alone is sufficient to account for this enormous mortality from Diarrhoea (sic), when we consider the dangers of bowel infection incurred through the consumption of unsterilised cow's milk, the disordered state of the bowels produced by the indigestible constituents of such milk, and the wholesale use of farinaceous foods. Cow's milk, as supplied in towns, especially in the summer time, generally swarms with bacteria...if a young infant cannot be fed naturally by the mother it is absolutely necessary to substitute a diet free from harmful germs...Such a diet is provided by the "Allenburys" Milk Foods.

Figure 2.1 Contemporary understanding of factors thought to influence infant mortality

Source: Allen and Hanbury's (1913:7) *Infant Feeding and Management* (author's own copy).

---

[7] Such a booklet would probably only reach those mothers intending to bottle-feed their infants and who could afford 'Allenburys' milk foods.

Work[8] would have a detrimental effect on the unborn and newborn infants, if, as Weir (1878:5) claimed, young mothers were likely to work until a few days before confinement and resume work soon afterwards. Furthermore, in 1891 the MOH for Shepshed, Doctor G. Cardno Still, claimed that

> [t]he majority of the factory-working females here suffer more or less from anaemia, which is mainly caused by working in a close, vitiated, atmosphere (CMOH1891:19).

In the first decade of the twentieth century, Guha (1993:398), in his study of the British Army in India, found between 194 and 326 women per 1,000 were admitted to hospital for anaemia and debility. Anaemia was a medical condition for which doctors advised against breastfeeding (Fildes 1998:259). We do not know if the women factory workers in the Shepshed Urban District were so advised but if they were then the fewer babies being breastfed could partly explain the raised infant mortality there at the end of the period of this study. However, in both the Shepshed and the Loughborough Urban Districts not all mothers worked and not all female factory workers were mothers.

Nutrition has been a key feature of the debate on mortality decline following the publication of McKeown's (1976) *The Modern Rise of Population*[9]. This work deals with mortality decline at *all* ages and is focussed mainly on what was occurring in the nineteenth century as a whole. It is not, therefore, directly relevant to the present study,

---

[8] Opinions regarding those mothers who continued to work after having children have polarised. On the one hand it is argued that work takes the care of the child away from the mother, prevents breastfeeding and encourages the use of sedation (Weaver 1871; Weir 1878; Jones 1894: Newman 1906). On the other hand it is suggested that the extra income brought in by the mother more than compensates for whatever the child loses by the mother working, by providing extra and better nourishment, warmth and clothing, etc. (Niven 1903; Brend 1917; Dyhouse 1978; Fildes 1998). For many unmarried mothers the only option was to work, unless she had the support of her family. Her small income would have provided necessities rather than extra benefits, and at the same time her child would be denied much of her care. Fildes (1998: 258) considered that illegitimate infants in all areas were unlikely to be breastfed.

[9] Whether or not nutrition was the key influence on nineteenth century mortality has been termed the 'McKeown debate'. McKeown aimed to explain the 'modern rise of population' that occurred in Europe from the eighteenth century onwards in terms of falling mortality through rising living standards and per capita nutritional intake.

which is focused on the onset of the sustained decline of *infant* mortality at the *start* of the twentieth century. An Inter-Departmental Committee Survey in 1904 also drew attention to the defective diet of babies and young children, noting that thirty-three per cent of all children were undernourished and actually going hungry (Howe 1976:207), a fact that must challenge McKeown's theory of nutrition as a key factor of mortality decline, at least for infants, at that time. [However, it may be that a higher percentage of children than this were undernourished in, say, the 1890s.]

Occupational environments

Garrett *et al* (2001) used data primarily from the 1911 census to investigate the interactions between environment, social class, and infant and child mortality in 13 areas across England and Wales. Garrett *et al* (2001:107-8) admitted that one of the major limitations of their work was that they were not able to produce separate measures of infant and child mortality. Their work is, therefore, not directly comparable to that of the present study, which is concerned with infant data only. One should also note that the 13 locations studied were not necessarily representative of the nation as a whole since they over-represented places with populations of over 25,000 and under-represented rural districts (Garrett *et al* 2001:116, 118).

Measuring other environments against the manufacturing one, Garrett *et al* found the industrial structure of a place lent it a particular character, connected to factors affecting the health of the inhabitants. With SEG V as the standard for comparison, they observed a clear survival gradient from classes I to V, with children born to men in class 1 over 50 per cent more likely to survive up to age 5 than those of Class V, while the children of agricultural labourers experienced a more than 60 per cent better

survival rate. However, Garrett *et al* observed (2001:155) the differences were due to the spatial segregation of social classes, and that the social class gradient was stronger in the worst environments. They (Garrett *et al* 2001:182) admit that the reasons for this are unclear and further analysis would require individual-level data with cause of death information. From an analysis of location that was limited to aggregated county boroughs, aggregated 'other urban districts' and aggregated rural districts, Preston and Haines (1991) suggested that social class made an enormous difference to mortality in England and Wales. Haines (1995:314-5) concluded that the decline in infant and child mortality in England and Wales during the 1890s and 1900s was more rapid in the higher social classes. However, Preston and Haines (1991:175) found that in the USA, race was more important than the geographical variables of size of place, region of residence and state income level, but this was a factor that was of relatively little importance in England.

While echoing the social class gradient in mortality indices observed at the national level for England and Wales by Preston and Haines (1991), the data set used by Garrett *et al* revealed a substantial gradient across the four environments of Agricultural, White Collar, Light Industry and Staple Industry. While children born in agricultural areas were forty per cent less likely to die than children overall, the urban-rural gradient was complex, showing striking differences in child survival between places dominated by a single industry and less mono-cultural urban areas. Mining areas were often the worst influence on child survival and were mostly rural, although they had a distinctly urban character. Garrett *et al* (2001:49-50) went on to investigate whether the variation in mortality by occupation could be explained by the distribution of occupations over environments, using multiple regression techniques on certain variables. They admitted

that the census was silent on income, feeding methods, sanitation and water supply. Vaccination data too is silent on these issues, but the present work attempts to overcome the problem of income by using the rateable values of the property in which the family of an infant lived, as a measure of income (see Chapter 7).

Watterson's (1988) class-specific estimates for the period 1895-1911 showed an inverse association between infant mortality and socio-economic group, although before the turn of the century the IMRs for agricultural workers were lower than for the professional classes of SEG 1. The data for the period 1888-1910 show this pattern occurred in the Loughborough Sub-registration District, but by drawing on periodic and area data it was possible to reveal a more complex pattern. Vaccination register data do show the different levels and trends in infant mortality within the sub-registration district, but do not provide a direct explanation of either. Any explanation can only be hinted at in the coincidence of changes in the pattern of infant mortality with other changes, for example in the local infrastructure.

Watterson too (1988:298-9) investigated infant mortality amongst miners and agricultural workers and found that income was not directly correlated with infant mortality, since the annual income of miners was at least double that of agricultural workers but the risk of their infants dying was one-third greater. This was not borne out in the Loughborough Sub-registration District. There, from vaccination register data, we find that the majority of miners lived rurally and that their infants experienced one of the lowest IMRs of those occupations analysed, at 91 deaths per 1,000 births, during the period 1888 – 1910. However, Watterson observed (1988:302), for the period 1895-1911, that urban occupations saw the most dramatic falls in infant mortality.

These could take place at any level of income although they were enhanced by high or regular income. Occupations that were mainly rural, or substantially rural, were unable to benefit from the improvements that were being achieved in high-density urban living, an experience that was paralleled in parts of Europe as noted above.

Garrett *et al* (2001:185) observed that all those who have looked at the trend of infant and child mortality over time using the 1911 census have commented upon the widening of social class differentials. Woods (2000) noted that infant mortality declined at different times in different groups, with a reduction in the IMR for SEG 1 occurring first, at the end of the 19th century, followed by a further substantial reduction in the IMRs for SEGS I, II, III and IV in the early years of the new century. The IMR for SEG V, however, did not fall substantially until 1905, in England and Wales as a whole.

Table 2.4 Infant mortality by social class in England and Wales in 1894, 1901 and 1910 together with the absolute and percentage changes between these dates

	Infant deaths per 1000 births			Absolute change		Percentage change	
Social class	**1894**	**1901**	**1910**	**1894-1901**	**1901-1910**	**1894-1901**	**1901-1910**
I	106 (106)	90 (83)	57 (52)	-16 (-23)	-33 (-31)	-15 (-22)	-37 (-37)
II	124 (121)	130 (113)	76 (81)	6 (- 8)	-54 (-32)	5 (- 6)	-42 (-28)
III	127 (129)	128 (121)	80 (85)	1 (- 6)	-48 (-36)	1 (- 5)	-38 (-30)
IV	128 (131)	138 (123)	95 (92)	10 (- 8)	-43 (-31)	8 (-6)	-31 (-25)
V	171 (146)	149 (145)	110 (111)	- 22 (- 1)	-39 (-44)	-13 (1)	-26 (-30)
VI	159 (144)	117 (136)	102 (108)	-42 (- 8)	-15 (-28)	-26 (-6)	-13 (-21)
VII	156 (148)	165 (144)	123 (116)	9 (- 4)	-42 (-28)	6 (-3)	-25 (-19)
VIII	97 (96)	95 (91)	36 (76)	- 2 (- 2)	-59 (-15)	-2 (-2)	-62 (-16)

Notes: The figures in brackets are the estimates made by Woods *et.al* 1988 for 1895-7; 1901-3, and 1910. The classes are those devised by the Registrar General. Szreter (1984:522.46) has argued that Classes I-V were groupings of occupations that displayed similar levels of *fertility*, whilst Classes VI, VII and VIII (textile workers, miners and agricultural workers respectively) were occupations that did not fit into the scheme. In spite of this somewhat dubious origin, the classification has been so widely adopted that most scholars have adopted it *faute de mieux*.

Sources: Woods *et al* (1988: 364); Garrett *et.al* (2001: 188).

Table 2.4 is reproduced from Drake (unpub:10) and combines data from both Woods *et*

al (1988) and Garratt *et al* (2001). He observes:

> the two sets of estimates reveal sizeable differences in the IMRS for individual classes at individual dates. It would, then, be unwise to place too much reliance upon them. However, if we step back a bit, it is apparent that both sets of estimates reveal certain common features:
>
> First, the higher the social class, the lower the IMR, although differences between Classes II-IV were small and Class VIII (agricultural labourers) had a much lower IMR than expected and one that was closer to that of Class I than to that of any other class.
>
> Second, the IMRs for all classes (Class VI in the Garrett *et al* 2001 *op cit* excepted) showed no marked fall in the second half of the 1890s.
>
> Third, the IMRs of the different classes were closer together in the mid-1890s than they were in 1910.
>
> Fourth, there was a dramatic fall in the IMR of all classes in the course of the first decade of the twentieth century.

CONCLUSION

It is apparent from this review of earlier work on two central aspects of the study of infant mortality that many conflicting findings have emerged across time, space and class. Even at the national level very different levels of infant mortality and different patterns of change have been found. Within countries, the situation appears even more complex. Although some findings are based on individual level data, most come from aggregates of greater or lesser size. Even when individual level data is available, as in the Garrett *et al* (2001) study, we find that it was impossible to distinguish between infant and child mortality, which, given the known differences between the two, is obviously a cause of some concern.

Earlier studies have also turned out to be much stronger on observation than on explanation. Thus we have plenty of statistics, albeit often at relatively high levels of aggregation. But explanations derived from these tend not to be so plentiful or so convincing. As Schofield (1998:1) said, national or regional aggregates may do little

more than 'reflect an average condition that few communities actually have experienced'. In part this is because the interaction between variables is a complex one, as studies of urban-rural and class differences have shown. In this thesis, it is hoped that the nature of the evidence (in particular that derived from the vaccination registers) and its deployment at the micro-level will help to clarify at least some of the issues. For instance, the vaccination registers tell us the precise age at death in days, of all infants up to the age of twelve months, both legitimate and illegitimate. As the registers also provide information on the occupation of individual fathers, we can derive a measure of social class that can be linked to address and hence environment, down to street level. The registers also enable us to highlight the timing of the decline in different parts of the Loughborough Sub-registration District, to discover whether or not what Lee (1991:56, 61) referred to as the so-called 'apparent discontinuity' in infant mortality rates at the turn of the century existed or not. Because the data from vaccination registers allow us to measure infant mortality by social class and location simultaneously, as was done by Garrett *et al* but not by Watterson or Preston and Haines (Garrett *et al* 2001:105-6), it is possible to investigate concurrently the differences in infant mortality by socio-economic group, using the father's occupation as a surrogate measure, and also by the rateable value of the property into which the infant was born. Such individual level data has not been available to earlier researchers. Two major studies addressing the issues raised above are presented in Chapters 5 and 6. In Chapter 7 the vaccination data is used to cast light on the impact on infant mortality of births outside marriage, multiple births, seasonality, and rateable values. We will also take a look at the gender and age distribution of infant deaths. These factors were mainly those viewed by both Newsholme and Newman as accounting for 'variations in infant mortality rates rather than for causes of the secular decline' (Woods *et al*

1989:120). There is also a section on infant mortality assessed with reference to the geology of the place of birth. Next, however, we will present the exciting sources on which the study is based (Chapter 3), followed by an account of the place in which our discussion has been set (Chapter 4).

3

Two major sources

THE VACCINATION REGISTERS

In this chapter I evaluate an exciting 'new' source - the vaccination registers –together with a complementary source - the Medical Officer of Health (MOH) reports. I describe the vaccination registers as 'new' and exciting because they have barely been used, despite being widely available[1], and, until recently, never in the study of infant mortality[2]. For the sake of brevity and convenience I have used the term 'vaccination registers' to include the vaccination registers proper (the vaccination birth registers or VBRs) and the infant death registers (IDRs). The former record whether infants born in a sub-registration district were vaccinated, when and by whom. The latter are partial copies of the civil death registers and were used to check whether an unvaccinated child had died. Both sets of registers exist[3] for the Loughborough Sub-registration District, the vaccination registers proper from 1883-1931 and the infant death registers from 1887-1916. Thus each covers the core period of this study, 1888-1910.

---

[1] For a survey of existing holdings see Appendix 1. This is taken from Drake, M., and Razzell, P. (1997) *The decline of infant mortality in England and Wales 1871-1948: a medical conundrum*, Milton Keynes.

[2] Several publications have emerged from the project, of which this thesis is a part. See Clark 2003 and 2004; Davies 2003; Smith 2003 and James 2003, Drake 2003; in Drake, M. (In press) 'The vaccination registers'

[3] They are to be found in the Record Office for Leicestershire, Leicester and Rutland ref: G/7/154 & G/7/149.

Vaccination is a practice attributed to Edward Jenner, who, in the late eighteenth century, experimented with the administration of cowpox matter to immunise the individual against smallpox[4]. Vaccination (the word derives from the Latin *vacca,* meaning cow) stimulated the body to produce antibodies and become resistant to the infection, and also prevented the immunised person becoming contagious and a danger to others. Because the virus used to produce immunity to smallpox is stable, unlikely to mutate and well tolerated by humans and animals, it was subsequently used as the basis for further vaccines against other diseases. Vaccination gained favour early in the nineteenth century, perhaps because it was much cheaper than the isolation, nursing and burial of smallpox victims, the costs of which rested with the Poor Law Union. However, it was not until 1871 that all poor law unions were required to appoint vaccination officers and to set up the registration system that lasted until 1948. The 1871 Act was the culmination of a series of acts since 1853, when vaccination was made compulsory for all children by the age of three months[5]. These were designed to close the loopholes that had emerged[6]. In this the government was initially successful, for, within England and Wales as a whole, throughout the 1870s and the early 1880s, over 80 per cent of those eligible were vaccinated. Allowing for the fact that a not insignificant number of children died before they could be vaccinated, the actual

---

[4] It is the data contained in the vaccination registers, not the smallpox disease itself, that is important to this study. Williams (1994:409 Figure 7) found a large reduction in smallpox deaths for the ages 0-4 years from the mid-nineteenth century. County MOH records from 1890-1910 only show a single infant death from smallpox in the Loughborough Sub-registration District: that occurred in 1903.

[5] The form presented to parents at registration stated they must have their child vaccinated *'before it is three months old, or at the next Public Vaccination held in the District after the child has attained that age.'* These requirements were laid down in the Vaccination Acts of 1867 and 1871. A completed form from the year 1884 was found in the pages of the Loughborough Vaccination Birth Register (ROLLR G/7/154/2: Birth No 290 – see Illustration 1). The 1898 Act increased the permitted period for vaccination to six months, and a partially completed form from Leicester in the 1900s (author's own copy – see Illustration 2), covered by the Vaccination Acts 1867 to 1898, shows this.

[6]An excellent summary of vaccination legislation can be found in N William's (1989:156-171) unpublished PhD thesis – a list of the relevant legislation is provided in Appendix 2.

compliance percentage was undoubtedly higher.[7] Jones (1894:13) commented:

> It is unnecessary to discuss the prophylactic value of vaccination – it is only needful to mention that since 1851 there has been a continuous decline in infant mortality from small pox, that the decline has been simultaneous with the more efficient performance of obligatory vaccination; and that the decline in mortality does not correspond to the decline in the general death-rate, which has been attributed to better sanitation.

Nonetheless, vaccination was not completely effective [8]. In Leicestershire it was argued that, since only the recently vaccinated were not at risk, the 'Leicester Method'[9] of notification, isolation, quarantine, and disinfection was preferable as a means of combating smallpox epidemics (Frazer 1980:315-332). The resultant low vaccination rates are, however, a bonus for research into infant mortality as it means infants were in observation in the vaccination registers for longer (discussed below).

A strong anti-vaccination movement emerged, one of its centres being nearby Leicester (Williams 1994)[10]. The movement was inspired partly by religious objections to the introduction of foreign material into the blood, partly by the perceived and actual dangers of the vaccination procedure itself, and partly by the unprecedented invasion of individual freedom the law entailed (Biggs 1912). In 1888 the Government responded by setting up a Royal Commission, the immediate effect of which was to reduce compliance quite dramatically. When the Commission reported, it recommended the abolition of repeat fines for non-compliance with the 1871 Act, the extension of the period by which a child had to be vaccinated to six months and the introduction of a

---

[7] Annual returns are to be found in the annual reports of the Medical Office of Health for the local Government Board in the British Parliamentary Papers.

[8] The body's immunity wore off over time, which led to mistakes being made in the diagnosis of vaccinated adults suffering mildly from the infection. This, in turn, allowed epidemics to take hold.

[9] Doctor C. K. Millard, appointed as Leicester's Medical Officer of Health in 1901, coupled the 'Leicester Method' with the vaccination of contacts (Frazer, 1980:322-3)

[10] Leicester 'had become the anti-compulsory vaccination capital of the country by 1885' Frazer (1980:319).

clause allowing parents to opt out of the legislation if they could demonstrate that they had a conscientious objection to their child being vaccinated. The government accepted the recommendations and incorporated them into an act of 1898. Paradoxically the compliance rate then rose, although to nothing like the levels seen in the 1870s.

Table 3.1 *Vaccinations as a percentage of births, Loughborough Sub-registration District, sample years between 1883-1908*

	Numbers of Births	Percentage of children vaccinated
1883	809	84.6
1888	831	78.3
1893	813	16.3
1898	831	16.0
1903	847	35.5*
1908	826	19.0

* The increase in vaccination in 1903 coincides with a smallpox epidemic.

Source: Vaccination Birth and Infant Death Registers.

Table 3.1 shows the percentages vaccinated in the Loughborough Sub-registration District in sample years between 1883 and 1908. The figures reflect the point just made, namely that after initial success, the proportion of children vaccinated fell dramatically. The fall was more acute in Loughborough than in the country as a whole, probably because the anti-vaccination movement, so strong in nearby Leicester, had a considerable influence in the town[11].

Table 3.2 (below) shows the situation in the Loughborough *Registration* District on an annual basis. In 1911, one of Loughborough's vaccination officers was granted £15 compensation for lost fees 'due to recent legislation simplifying the procedure in

[11] During the late nineteenth century, the chairman of the Loughborough Local Board of Health, Mr J Cartwright, commented: 'We are also suffering from small pox owing to the barbarism...of those who will not have their children vaccinated' (Priestley 1955:6).

obtaining certificates of conscientious objection' (Minute Books Loughborough Union 1911: 473).

Table 3.2 *The progress of vaccination in the Loughborough Registration District 1872-1904*

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Year	Births	Successfully vaccinated	C/B*1000	Insusceptible to vaccination	Had smallpox	Died unvaccinated	G/B*1000	No. certs. Of conscientious objection	I/B*1000	Vaccination postponed	Remaining	L/B*1000	Children not finally accounted for per 1000 births
1872	904	754	834.1	1	1	119	131.6			29	32.1	32.1	
1873	780	643	824.4	1		100	128.2	5		26	33.3	39.7	
1874	946	806	852.0			117	123.7	1		22	23.3	24.3	
1875	895	766	855.9			110	122.9	3		16	17.9	21.2	
1876	950	814	856.8			120	126.3	6		10	10.5	16.8	
1877	1012	876	865.6			123	121.5	3		10	9.9	12.8	
1878	945	815	862.4	2		115	121.7	2		11	11.6	13.8	
1879	989	871	880.7			99	100.1			19	19.2	19.2	
1880	985	834	846.7			120	121.8	3		28	28.4	31.5	
1881	983	867	882.0			97	98.7	1		18	18.3	19.3	
1882	998	871	872.7	1		91	91.2	4		31	31.1	35.1	
1883	1007	858	852.0			101	100.3	3		45	44.7	47.7	
1884	906	762	841.1			102	112.6	5		37	40.8	46.4	
1885	985	826	838.6			99	100.5	22		38	38.6	60.9	
1886	1037	845	814.9			132	127.3	22		38	36.6	57.9	
1887	984	807	820.1			107	108.7	28		42	42.7	71.1	
1888	960	768	800.0	2		93	96.9	41		56	58.3	101.0	
1889	1016	650	639.8			132	129.9	4		230	226.4	230.3	
1890	945	244	258.2			121	128.0	4		576	609.5	613.8	
1891	955	166	173.8			137	143.5	3		649	679.6	682.7	
1892	947	135	142.6			118	124.6	1		693	731.8	732.8	
1893	922	89	96.5	3		137	148.6			693	751.6	751.6	
1894	946	60	63.4			142	150.1	2		742	784.4	786.5	
1895	981	38	38.7			158	161.1			785	800.2	800.2	
1896	1022	48	47.0	1		144	140.9			829	811.2	811.2	
1897	922	62	67.2			132	143.2	513	556.4	1	214	232.1	233.2
1898	952	107	112.4			138	145.0	558	586.1	10	139	146.0	156.5
1899	989	223	225.5			116	117.3	432	436.8	95	123	124.4	220.4
1900	963	212	220.1			119	123.6	423	439.3	77	132	137.1	217.0
1901	942	230	244.2			96	101.9	440	467.1	65	111	117.8	186.8
1902	965	335	347.2			85	88.1	405	419.7	66	74	76.7	145.1
1903	980	388	395.9			86	87.8	437	445.9	25	44	44.9	70.4
1904	931	357	383.5	1		89	95.6	355	381.3	78	51	54.8	138.6

Source: Annual reports of the Medical Officer of Health of the Local Government Board 1872-1904; British Parliamentary Papers. Compiled by Professor Michael Drake 2004.

The implementation of the 1871 Act

In the vaccination registers for the Loughborough Sub-registration District from 1888 to 1916, the date of vaccination and the name of the doctor performing it or authorising a

certificate of exemption was noted. If the infant was sickly, a certificate of exemption or postponement of vaccination could be given by a doctor. In the Loughborough Sub-registration District, certificates of exemption were most likely to be given by one particular doctor, which suggests either a single point of application or a sympathetic physician. Whilst the names of some doctors appear frequently in the Loughborough registers, others may occur only once amongst the approximately eight hundred births listed each year. These single instances often refer to vaccinations performed outside the county, indicating that the family had moved since the birth. The infant could be vaccinated by the family's own doctor, or taken to the public vaccinator at a local vaccination station. There was no pattern to the parents' choice of vaccinator in the Loughborough Sub-registration District. This may be due to the low numbers of parents in socio-economic groups I and II, since they were the ones most likely to pay a private vaccinator to avoid the perceived stigma of public vaccinations overseen by the poor law institutions. Williams (1994:400) found private vaccinations were not included in the routine figures that she used from the Annual Reports of the Poor Law Commissioners, the Poor Law Board, and later the Local Government Board. However, had she used the returns contained in the annual reports of the Medical Officer of Health of the Local Government Board, she would have found that all vaccinations were reported, public as well as private[12].

The vaccination registers contain the civil birth register number, the date of birth, gender and name of the child; the name, address and occupation of the father (or mother if the child was born outside marriage), and the date on which the notice of the requirement to vaccinate was given to the parent. Further details include the date of

[12] For this and other information on the extent of compliance see Drake, M. (In Press) 'The vaccination registers'.

successful vaccination, postponement, exemption, insusceptibility; or death if this occurred before vaccination. Sometimes a reference number relating to the vaccination officer's report book appears. The report books give further information on infants who for one reason or another – usually because they had left the district – had either not been vaccinated or died within the district of their birth. None have survived for the Loughborough area. Sometimes the vaccination register contains a pencilled note saying that the infant had moved away or not been found at the birth address. In the Loughborough registers, the vaccination officer sometimes noted the place to which the child had moved when vaccination was notified from outside the county, but there is no way of knowing how comprehensive these notifications were.

The infant death registers give the civil death register number, the civil birth register number when found, the name and occupation of the father (or of the mother if the child was born outside marriage), the date and place of death, and the child's name, gender and age at death. The cause of death is not given. These registers were intended to record children up to twelve months of age only, but instances of deaths occurring up to fifteen months are found in the Loughborough ones.

Some vaccinations appearing in the Loughborough registers were carried out at a relatively late age. For example, some children born in 1908 were not vaccinated until 1923. In 1893, groups of vaccinations coincide with the ages when children may have moved up to, or left, their elementary school, suggesting a liaison between the schools and the vaccination officer. Only deaths of unvaccinated infants should have been recorded in the vaccination registers: the law was quite clear on this. A death should be entered by the vaccination officer, in the column provided in the vaccination birth

register, '*only when he had not previously received certificates of vaccination or insusceptibility*' (BPP 1872: XXVIII: 77-81). In the Loughborough vaccination registers, some deaths are recorded in pencilled notes but the reason for this is not known.

Local Government Board statistics suggest about two-thirds of all infant deaths in late nineteenth century England and Wales occurred *before* vaccination and should, therefore, appear in the vaccination registers proper (Drake & Razzell 1997:15). The converse is that the remaining one third of infant deaths may not be recorded. For the period 1888 – 1910, 208 infant deaths were recorded in the infant death registers of the Loughborough Sub-registration District, but not in the vaccination birth registers. In the earlier years of the period, between the years 1888 and 1902, most of these deaths occurred, quite properly according to the legislation, after vaccination. A comparison of death rates for vaccinated and unvaccinated children would be interesting in view of the strong anti-vaccination movement, but this is not possible because of the uncertainty surrounding the completeness of such records. Some pencilled notes in the infant death registers state that an infant had been vaccinated, although it is not known whether all were so recorded and there are fewer instances noted in the twentieth century registers than earlier. This may mean fewer infants died after vaccination, or the practice changed.

The issue of possible changes in the standard of record keeping calls into question the accuracy of the information given in the vaccination registers. As noted earlier, the biographical facts about each child appearing in the vaccination registers – name, date of birth, gender, address, name and occupation of father (or mother if born outside

marriage) - are copied from the civil birth registers and so are subject to transcription errors. Without access to the civil birth registers, it is impossible to assess the accuracy of the transcription, although the number of obvious errors found in the Loughborough registers appears to be relatively small. Sometimes the name of the infant does not tally with its gender, or the immediate repetition of an address or occupation seems unlikely. On one occasion the 'cause of death' appears in the 'father's occupation' column. Some of these 'errors' may be transcriptions of errors in the civil registers themselves. The decision as to whether or not typographical errors were sufficient to distort any findings of a piece of research would thus need to be made for the registers in each individual area and would depend on the intended use of the data. For example, obvious errors in occupation would be important to a study involving socio-economic groups, but not necessarily to a study of age at death.

There are several ways the user can assess the accuracy of the vaccination registers; firstly by checking that the correct details appear in the specified columns, secondly by using other births in the same family in previous or subsequent years to check anything that is unclear, and lastly by simply using the records and developing an instinct for the area and the people within it. The Loughborough registers suggest the transcription was an accurate one since so few mistakes of the kind just noted, were found.

For addresses within the Loughborough Urban District, considerable detail is given such as street names and house numbers. But for the Shepshed Urban District, the smaller of the two urban districts in the Loughborough Sub-registration District, often only the name of the street appears. In the earlier registers covering the small villages in the Loughborough Rural District, only the settlement is named. In later years, the

registers mostly, but not always, give a fuller address for the larger rural settlements. Linking infants and their families in the vaccination registers with other sources that give an address, such as the census enumerators' books, can therefore be difficult and uncertain. The 1891 census, for example, gives full addresses for people living in Shepshed but these are not given in the earlier vaccination registers.

Table 3.3 *Annual totals of births and deaths under 1 year taken from the Registrar General's returns and the vaccination registers: Loughborough Registration District 1888 – 1910*

Year	Births Registrar General	Births Vaccination Registers	Infant Deaths Registrar General	Infant Deaths Vaccination Registers
1888	821	831	114	127
1889	848	829	158	135
1890	804	810	127	118
1891	798	813	132	132
1892	816	790	131	123
1893	801	813	135	136
1894	799	787	143	135
1895	847	853	152	136
1896	885	880	122	134
1897	779	779	123	133
1898	819	831	145	118
1899	860	849	112	114
1900	835	837	154	136
1901	811	817	111	124
1902	832	825	112	98
1903	846	847	111	115
1904	809	833	107	109
1905	858	836	126	128
1906	882	887	144	135
1907	894	903	104	95
1908	849	826	112	80
1909	732	737	65	81
1910	710	710	61	62
Total:	18,935	18,923	2,801	2,704

Source: Registrar General's Registration Reports (England) Quarterly and Weekly, compiled by Michael Drake, and Vaccination Register data, compiled by the writer.

A comparison was made between the Registrar General's totals of births and deaths taken from civil registration data and those in the vaccination birth and infant death

registers, for each year from 1888 to 1910 (Table 3.3). The Registrar General gives 18,935 births and 2,801 deaths. The comparable totals in the vaccination birth and infant death registers are 18,923 and 2,704. The differences in the annual IMRs were not found to be significantly different at a level of five per cent, except for the year 1908.

Table 3.4 *A comparison of births and deaths compiled from Registrar General and Vaccination Register Data, Loughborough Sub-registration District, 1888-1910, in five-yearly groups*

Period	Births		Deaths	
	Registrar General	*Vaccination Registers*	*Registrar General*	*Vaccination Registers*
1888-1890	2473	2470	399	380
1891-1895	4061	4056	693	662
1896-1900	4178	4176	656	635
1901-1905	4156	4158	567	574
1906-1910	4067	4063	486	453
Total	18935	18923	2801	2704
In-migrant deaths to infants not recorded in VBR				128
Total				2832

Source: Registrar General's Registration Reports (England) Quarterly and Weekly, compiled by Professor Michael Drake, and Vaccination Register data compiled by the writer.

Table 3.4 presents the data on a quinquennial basis and again shows the totals from the two sources tallied closely throughout the period. An exact match each year is not to be expected because the Registrar General's figures are based on the date of registration and the vaccination records on the date of birth. That the figures from both sources are so close gives us great confidence in the accuracy of the transcription for, at least, this registration district. All infant deaths should appear in the civil registers of deaths, and the close tally suggests that the transcript of the infant death register covers all deaths, whether they occurred before or after vaccination or were of children born outside the

district. In 1908, for example, there are eight more deaths recorded in the infant death register than in the vaccination birth register. Of these, six were of children born outside the area and the remaining two were babies found in the river Soar, whose parents were unknown. I also found 67 deaths (2.48 per cent of all deaths) recorded in the vaccination birth registers but not in the infant death register during the period 1888 – 1910. These are likely to be of infants who had left the area before vaccination, had been followed up by the vaccination officer and whose fate had been reported to him. One can only imagine the effort that is likely to have gone into tracking down each of these children. Information like this is an indication of the conscientiousness of at least one vaccination officer and so inspires faith in the system – and confidence in these particular records.

Table 3.5 suggests that the number of out-migrants who died in infancy was so small that their exclusion from calculations of the IMR would make little difference. It has to be admitted, however, that we do not know if all such deaths were returned to the vaccination officer in Loughborough.

Table 3.5 Infant mortality data including and excluding known out-migrant infants, sample years from 1888 – 1908, Loughborough Sub-registration District

Year	Total Infant Mortality Rate (IMR)	IMR with out-migrants removed
1888	152	161
1893	166	166
1898	150	153
1903	136	143
1908	96	98

Source: Vaccination registers.

The vaccination registers supply the denominator for the calculation of the IMR. Children born outside the registration district would obviously not appear in the

registers. Were their numbers such as to significantly affect the area's IMR? There are 128 deaths in the Loughborough infant death registers, in the core period of study, whose births were registered elsewhere. In these instances the precise date of birth is not known so such entries are of limited use. These infants were excluded from this study. To include them would present a possibly greater problem of distortion caused by the lack of information on *surviving* in-migrants. An estimate of the number of surviving in-migrant infants can be made by using the number of in-migrant deaths and the IMR for the year, on the assumption that the IMR for both groups is the same. [There is no information to prove this either way.] Calculated in this way, an estimated 25 infants came into the Loughborough Sub-registration District area each year. There were in the region of 800 births registered annually for the whole district. Such a small percentage (3.1 per cent) of estimated in-migrant births suggested these events could be safely excluded from the data set. Conversely, as mentioned above, infants found in the vaccination registers whose deaths were reported elsewhere *were* included in the analyses, although it is not known if *all* such deaths were recorded. This avoids the issue of whether in- and out-migration balance each other out and concentrates on maintaining the basis of the cohort, i.e. only those births in the registration district in a specific year are tracked for a date of last observation up to twelve months of age. While this was possible for the Loughborough Sub-registration District, data for each vaccination district would need to be assessed individually.

An estimate of net migration can be gained from the difference in population at two contiguous census dates and between the number of births occurring between those dates. For the Loughborough Sub-registration District, comparing the estimated population from the Medical Officer of Health Reports for 1901 and 1911 gives an

increase of 1,925 on a population of 31,118 in 1901. However, adding the number of vaccination register births for a decade, and deducting the number of deaths at all ages (given in the County Medical Officer of Health Reports) gives an overall increase of 3,402 from 1901-1910. This suggests that there was a net out-migration in the region of 1,477 during the years 1901-1910. This figure is an approximation for two reasons: first, the MOH's population totals are estimates, though based on the census, and second, the census was taken in March or April while the MOH and vaccination register data is for calendar years. While data for a district with large numbers of migrants might suffer from some distortion that would require careful handling in any analysis, such an area would provide the opportunity to compare the infant mortality of migrants and the indigenous population. This could be especially useful for environmental studies. However, since net out-migration was less than five per cent in the Loughborough Sub-registration District for the decade from 1901, it was not considered sufficient to affect the results of analysis.

The 'conventional IMR' is the number of deaths under one year of age registered in any one calendar year per 1000 live births recorded in that same year. As then, the births and deaths are not directly linked, the deaths in the numerator are not drawn solely from the cohort of births in the denominator. It is normally assumed, however, that any differences are likely to be small and will balance each other out. This period IMR can, however, be misleading if there is a marked increase or decrease in the number of births and/or infant deaths. The calculation for the period IMR, which appears as a square on the Lexis surface[13] (see Figure 3.1), is:

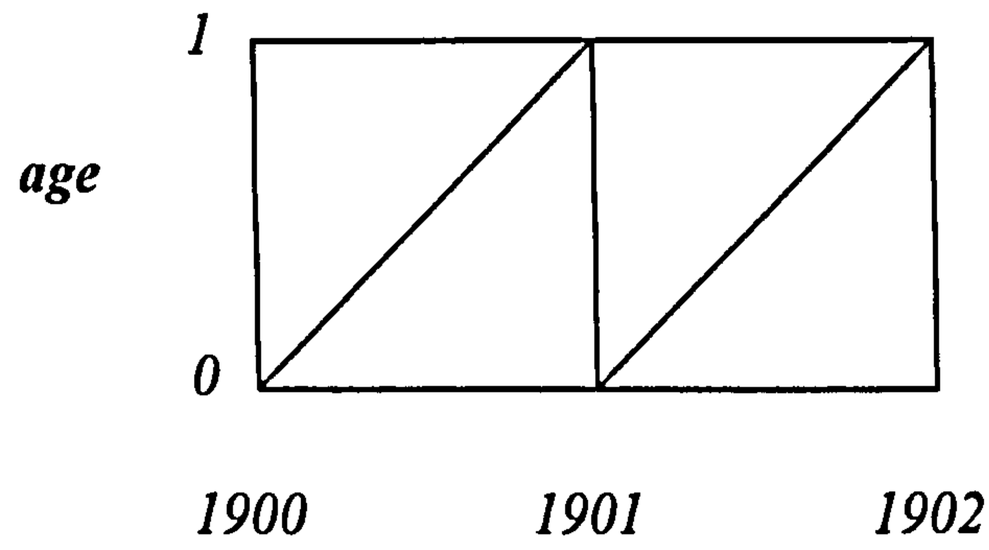
[13] A Lexis diagram is simply a structure drawn so that one unit of time along the horizontal scale equals one unit of age up the vertical scale.

*IMR = 1000 * (infant deaths registered in a specific year/births registered in the same year)*

The vaccination registers provide information on births and infant deaths in a form that overcomes the problems associated with the 'conventional IMR' by enabling the calculation of a cohort IMR. This is achieved by tracking all deaths to a specific cohort of births, no matter in which calendar year the former occurred. The cohort IMR appears as a parallelogram on the Lexis diagram (see Figure 3.1 below) and is calculated as follows:

*IMR = 1000 * (infant deaths/the cohort of births from which the deaths are drawn)*

A Lexis diagram



Key: registration period (square – Registrar General's data using date of unrelated deaths)
c.f. date of birth period (parallelogram – vaccination register data using date of death of infant up to twelve months)

Figure 3.1 The areas of cohort and period data on the Lexis surface for one year of infant births and deaths using vaccination registers and Registrar General returns

Figure 3.1 illustrates the difference between cohort and period measures, using the year 1900 as an example. The diagram is not strictly accurate as the vaccination registers show there is always a backlog of births from the previous year that accounts for a considerable portion of births registered in the first quarter of the year. For example, the Registrar General's figures in the first quarter of 1900 will include a number of births from 1899 that were not registered until January 1900. [These can be allocated to the

correct year when using the vaccination registers. Also, births that occurred in December 1900, but were not registered until the first quarter of 1901, can be included in the 1900 cohort.]

In 1907, the Births Notification Act reduced the time limit for the registration of births to 36 hours. Prior to that, there are several instances in the Loughborough registers where one or two December births were registered up to three months later. There is even a unique instance of a family of children being added to the registers several *years* later! Using vaccination registers, these births can be allocated to their correct cohort. Period measures have important implications for the analysis of perinatal, neonatal, and post-natal deaths; longer-lived infants would be those most affected by the Registrar General's balancing out strategy. By using the cohort-based data provided by the vaccination registers it is possible to produce more accurate results.

A cohort calculation is only suitable when net migration is low enough to be ignored. Thus gains and losses due to migration may be sufficient in some districts to make analyses unreliable, but this was not the case in the Loughborough Sub-registration District. Here, the estimate of total in-migrant infants calculated from the deaths of infants born outside the area and the IMR for the sub-district [assuming the IMR for in-migrants is the same as for indigenous infants] suggests this was not a population where large amounts of gross migration were hidden by a small difference in net migration.

Both the period and the cohort IMRs assume that the number of births less the number of deaths in the selected group equals the number who survived to their first birthday:

Survivors at risk = Births less Cumulative Deaths*

**Deaths, not Births, are cumulative, since it is assumed that at any age in the first year of life, the number of survivors at risk is the number of births in the cohort minus the cumulated deaths up to that age*

Vaccination birth registers alone do not follow all infants for one year – for example, infants may not be followed after vaccination, or may not be traced. An equation to calculate IMRs using VBR data could be constructed as follows:

Survivors at risk = Births (+Cumulative Gains if these had been noted)
less Cumulative Deaths less Cumulative Losses

Tables of deaths and births at risk could then be calculated, and life tables produced, to discover the effect of out-migration on the IMR. To do this, the first year of life is divided into a number of age groups. Deaths, and those excluded by censoring, are then related to the number of survivors at risk in each age group, to estimate the mortality level for each age-period. These can then be combined to produce an overall measure of infant mortality. Although the purpose of this calculation is to produce a more accurate IMR than is possible from existing, aggregate-based figures, a caveat must be entered. Because there are fewer individuals in the risk-set at older ages - and the more complete the vaccination the smaller the number will be - the mortality rate at those ages may be subject to a high degree of uncertainty which will be carried into the overall IMR. There was, in fact, no benefit to be gained by using life table calculations in this study as the infant death registers are available between 1888 and 1910.

Although some differences between the period and cohort IMRs were expected due to their different parameters, when a two proportion test was calculated for the cohort and period data in each year, only one year, 1908, was significantly different at a level of five per cent. In that year, the Registrar General recorded 17 more deaths than appear in the vaccination registers. However, in 1909, the Registrar General recorded 16 fewer deaths than the vaccination registers and this is likely to account for the inconsistency. There was little difference between the sources in the numbers of births for the years

1907-1909 overall. The vaccination registers are likely to be the more accurate, as they record the deaths of specific infants, as discussed above. (It is worth noting in Figure 3.2 below that the Registrar General's period data suggest the decline of infant mortality began in 1901, in line with that of the country overall. Vaccination register cohort data, however, indicates the decline in this area began in the early to mid-1890s.)

Figure 3.2 A comparison of period and cohort data, Loughborough Sub-registration District, 1888-1910

Source: Period Data from The Quarterly Returns of Births Deaths and Marriages for England by the Registrar General, collected by Michael Drake (unpublished paper, Cohort Data from the Vaccination Birth and Infant Death Registers.

This investigation has indicated that the vaccination and infant death registers in Loughborough Sub-registration District are probably accurate transcriptions of the civil registers of births and deaths from which they were compiled, thus giving confidence in any resulting analysis. It should be noted that IMRs in this study are rounded down, not up, continuing the early MOH practice in Leicestershire. Unless otherwise stated, analyses in this study use data that is drawn from both the vaccination birth and infant death registers.

Medical Officer of Health Reports

The Reports of the Medical Officers of Health complement the vaccination registers by providing possible explanations of changes in the IMR e.g. cause of death statistics. The ones used here are either yearly reports produced by the Medical Officers of Health of individual districts within the Loughborough Sub-registration District, or compilations of these that went to make up the Annual Reports of the County Medical Officer of Health. Causes of death, accounts of epidemics, school closures, drainage, sanitation, water quality, the enforcement of government acts relating to health and the provisions for dealing with health problems are some of the issues addressed in these reports. Little of this information can be found elsewhere.

Only four MOH reports for the Loughborough Urban District, during the years covered by this study, are in a local history archive (the Loughborough Library). They cover the years from 1908 to 1911[14]. However the Wellcome Foundation Library in London holds reports for the years 1894, 1897, 1900, 1904-06 and 1908-09 for the Loughborough Urban and Rural Districts, together with reports for the Shepshed Urban District for the years 1893, 1900, 1902, 1903, 1905, 1906, 1908 and 1909. The reports of the County Medical Officer of Health for 1890-1911 are held at the offices of the Leicestershire Area Health Authority.

In reading these reports one must be aware that they may not be all that they seem as an MOH may exaggerate what was happening, to make his area appear more active than it really was or with the intention of accelerating improvements. Errors in the statistics exist and even when later pencilled corrections have been added, *they too* are not

[14] On re-visiting the archive, one of these has since disappeared!

always correct! For instance, in 1897 the County MOH (1897:31) gives the total number of infant deaths in Leicestershire as 851. This has been corrected by hand to 850, even though the figure for the urban districts was 397 deaths, somewhat less than the rural districts, which had 450 deaths[15], a total of 847. This discrepancy may be due to three deaths in the workhouse or hospital, indicating that such deaths may not always have been included. IMRs in the individual reports may differ from those calculated from the given numbers of births and deaths. In 1896, for example, the IMR for the Shepshed Urban District is given as 120, but, when calculated from the births and deaths provided, it appears to have been 183. The exact numbers of births and infant deaths used by the MOHs before 1900 are not always given in the body of the report only the birth and death *rates*.

Differences of only one unit either way may be due to the rounding of decimal places; larger differences suggest transcription or mathematical errors. In 1902, the Loughborough Urban District was alleged to have the highest IMR of all urban districts in the county, at 168, but elsewhere the rate was given as 141. Here it seems the County MOH simply named the wrong place beginning with 'L', choosing Loughborough rather than Lutterworth. Further errors seem to occur in the amalgamation of individual MOH reports into the County Report. MOH figures must, therefore, be used with caution.

Table 3.6 compares the number of births, deaths and IMRs given in the County MOH Reports, the Registrar General's returns and the vaccination registers for sample years

[15] Although contrary to the expected urban-rural dichotomy, this may be accounted for by the large size of the rural hinterland and the smaller size of the urban areas in the county (see Figure 4.1 below). At the time, Loughborough was the largest town in the county and infant deaths there in 1897 numbered 123.

Table 3.6: Comparison of births, deaths and IMRs from the Registrar General's returns, MOH reports and vaccination registers, Loughborough Sub-registration District, sample years from 1893-1908

Year	MOH Reports	Registrar General's Returns	Vaccination Birth and Infant Death Registers
		Births	
1893	840	801	813
1898	863	819	831
1903	884	846	847
1908	881	849	826
		Deaths	
1893	155	135	136
1898	150	145	118
1903	114	111	115
1908	114	112	80
		IMRs	
1893	184	168	166
1898	173	177	150
1903	128	131	136
1908	**129**	**131**	**96**

Note: Figures in red indicate a significant difference occurred at a level of five per cent from the emboldened figures.

Source: Loughborough data from the Vaccination Registers and County MOH data compiled by the writer; Registrar General data compiled by Professor Michael Drake from Registration Reports (England) Quarterly and Weekly.

from 1893 to 1908. Although there were differences in the totals of births and deaths, only in 1908 was there a significant difference in the deaths, and hence the IMRs, derived from the vaccination registers on the one hand and the MOH and Registrar General's reports on the other. However, as already noted in connection with Table 3.3, this year was the only one in this study where there was a significant difference between the period and cohort data.

The MOH figures become closer to those from the other two sources over time, although many more births are reported than for either of the other two sources. The idiosyncrasies of each source make them unsuitable for use in combination. However, the lack of significant differences indicates we can be confident that both sources are

trustworthy. By using them in tandem, they should help inform the debate on the rapid secular decline of infant mortality at the turn of the twentieth century.

TEXT BOUND INTO

THE SPINE

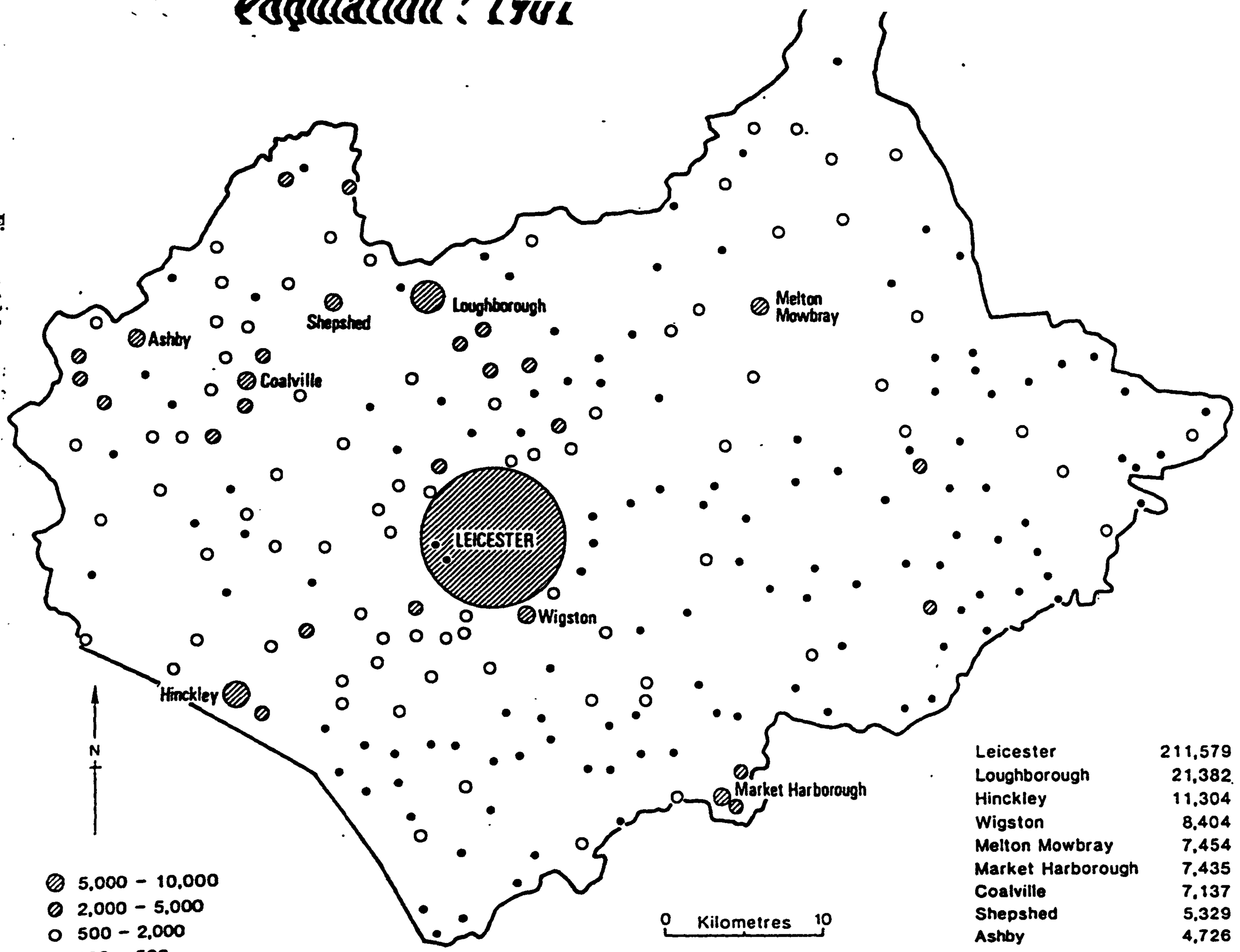


Figure 4.1 Map of Leicestershire showing various population settlements, including Loughborough and Shepshed – 1901

Source: Strachan, Dr A J (1986)

4

Setting the scene: Loughborough in context

THE SOCIO-ECONOMIC CONTEXT

By the last quarter of the nineteenth century, the majority of the Loughborough Sub-registration District's population was to be found in the Loughborough Urban District. Here the population had grown from 4,546 in 1801 to 21,508 in 1901, an almost a five-fold increase. The expansion of Loughborough[1] was fuelled, at the start of the nineteenth century, by its situation on the Grand Union Canal and later by the arrival of the Leicester to Melton Navigation and the Midland Railway[2]. It has been described too as the 'cradle of mechanical inventions that revolutionised the whole hosiery industry of England' (Cook 1934:44)[3]. It was not, however, a one-industry town: engineering and machine works; iron, brass and bell foundries[4]; dye and brick works; and a brewery, were part of its industrial base. Little of this reached Shepshed[5], the other urban centre

[1] Kelly's Directory (1891:733) describes Loughborough as a municipal borough, market, and union town, which was incorporated in 1888. Among its assets were a town hall, a library and a fire station. Markets were held on Mondays, Thursdays and Saturdays.

[2] At the end of the eighteenth century, Loughborough was turned from 'a sleepy village...into a thriving town' mainly through the construction of the Grand Union Canal (Deakin 1974:15).

[3] In 1801, 194 families were employed in framework knitting (Nichols 1804:8840-9).

[4] Kelly's Directory (1904:488) notes Messrs Taylor of Loughborough cast the 'Great Paul' bell, weighing 17 tons, for St. Paul's Cathedral in London.

[5] Kelly's directory (1891:787-8) describes Shepshed as a township and parish five miles west of Loughborough and fourteen miles north of Leicester, situated in a vale on the north margin of Charnwood Forest. In the 1880s the township of Shepshed had a station on the Charnwood Forest Railway and in 1887 it was placed under the control of a Local Board of nine members. There was a national school for 524 children (Kelly 1891:787).

within the Loughborough Sub-registration District. We have, then, two urban centres of quite different sizes with quite different histories and, by the end of the nineteenth century, different occupational profiles.

In 1901, the Shepshed Urban District was little more than a quarter the size of Loughborough with 5,700 inhabitants. Its population had barely doubled since 1801, when it was enumerated at 2,627. In the late seventeenth century, agricultural holdings here were small and the peasantry poverty stricken. It was in such areas that rural industrialisation became important, hence the growth of the cottage based framework knitting industry (Levine 1974:29). In the late eighteenth and early nineteenth centuries the Shepshed framework knitting industry enjoyed a boom. At the end of that period Shepshed[6] was described as 'the most intensively industrialised village in the county – in 1812 there were more than 1,000 knitting frames for a population of just over 3,000' (Levine 1974:23). From then on the cottage based industry in Shepshed declined. In the short term this was due to the depression that followed the ending of the Napoleonic Wars, and in the long term, to the movement of the hosiery industry into factory based units, a move that benefited Loughborough.

The period of growth experienced in both urban districts in the nineteenth century, encouraged by the hosiery trade, ended in the 1910s. Framework knitting was declining over the core period of this study as power frames, gathered in factories, superseded domestic, manual knitting frames. Vaccination data recorded over 160 births to framework knitters in the urban districts of Loughborough and Shepshed in 1888, but only 7 births in the Loughborough and 11 in the Shepshed Urban Districts in 1913. The

---

[6] Wright's (1892:608) Directory describes Shepshed as one of the oldest seats of hosiery manufacture in the district.

census abstract for 1901 (Table 35a:64) shows 6,619 working men in the Municipal Borough of Loughborough. The top three occupations were:

i)	Engineering	(1192)
ii)	Building construction	(896)
iii)	Hosiery manufacture	(669)

Of 3,325 women who worked, only 624 were married or widowed. The main occupations were:

i)	Hosiery manufacture	(1480)
ii)	Domestic service	(583)
iii)	Dressmakers and seamstresses	(375)

The large engineering firms employed mostly men, while women were employed mainly in hosiery factories and dyeing workshops. It is not known if those occupied in hosiery manufacture included framework knitters. Some framework knitters were women, although it was more usually a male occupation. These figures suggest that there were far fewer opportunities for men than women in hosiery manufacture and it seems unlikely that many male framework knitters were re-deployed in the hosiery factories. Families suffered as framework knitting declined. The Christmas morning breakfast for poor children in Loughborough fed seven hundred youngsters in 1903, although it is not known how many of these were the offspring of hosiery workers. In 1904 there was such a shortage of hosiery work that many children were semi-starving and receiving one daily meal at a soup kitchen. The Boot Fund, which aimed to provide footwear for the poor, was exhausted. 'Very many of the little things were clad in veritable apologies for boots and shoes – ragged, soleless, topless scraps of leather many of them were, affording no protection whatever against wet or cold' (Deakin 1979:69). While the poor children in Loughborough had the benefit of the daily meal from the soup kitchen, it is not known if a similar source of support was operating in Shepshed. This town had a boot and shoe industry, but did not have the engineering

industries of Loughborough as an alternative source of occupation. It is likely that the people of the Shepshed Urban District experienced greater hardship from the decline of the area's main occupation and this may have contributed to the lack of a decline in infant mortality there towards the end of the first decade of the twentieth century (see Chapter V). If cause of death data were released, it would be possible to see if there was an increase in deaths from causes attributable to malnutrition.

The Loughborough Rural District, which occupied the bulk of the land area of the Loughborough Sub-registration District (in 1901 it covered 20344 of the 28669 acres), remained rural. The largest settlements[7] were Hathern, Long Whatton and Nanpantan (see Figure 1.4). The only industries in the rural villages recorded in contemporary directories (Kelly 1891,1904) were framework knitting and farm working[8]. However the vaccination registers record comparatively few labourers as agricultural or farm labourers at this time, which suggests the farms were small enough to be worked without very much outside help. During the period of this study the population remained relatively steady at around 5500, as it had from the beginning of the nineteenth century.

Whilst within the Loughborough Sub-registration District the Loughborough and Shepshed Urban Districts shared an industrial base, although constituted differently, the rural district of Loughborough consisted of agricultural villages of various sizes spread throughout the hinterlands of the urban areas.

---

[7] The smaller villages of Belton, Charley, Thorpe Acre, Dishley and Woodthorpe had few births recorded in the VBRs.

[8] The farms produced mainly barley, wheat and oats with some root crops.

Although the home-working industry disappeared, the industrial base of the village of Shepshed developed. By 1921, the Ordnance Survey Map shows four hosiery manufactories, two smaller boot and shoe works and a lace manufactory in Shepshed. It was similar to the Loughborough Urban District in this and in having an urban core with a similar mix of housing within it. The population of the Shepshed Urban District was, however, as we have seen, less than a quarter of that of the Loughborough Urban District, being closer both in this and in acreage to the Loughborough Rural District[9] (see Table 4.1 below).

Table 4.1: *Population, acreage and persons per acre in the Loughborough Urban, Loughborough Rural and Shepshed Urban Districts in 1891, 1901 and 1911*

	1891	1901	1911
Estimated Population			
Loughborough U.D.	18196	21508	22992
Loughbrough R.D.	4459	4387	4579
Shepshed U.D.	4416	5293	5542
Acreage			
Loughborough U.D.	4275	3045	3079
Loughbrough R.D.	18171	20344	20242
Shepshed U.D.	5420	5280	5425
Persons per acre			
Loughborough U.D.	4.23	7.06	7.47
Loughbrough R.D.	0.25	0.22	0.23
Shepshed U.D.	0.82	1.00	1.02

Source: Compiled from the County MOH Reports

The density of population as measured in Table 4.1 is not very satisfactory, although it is, perhaps, worth noting that in 1899 the County MOH (1899:6) reported that the Loughborough Urban District was the most densely populated one in the County, having 6.9 persons per acre (CMOH 1899:6). This was, in part, due to a reduction in

[9] The village of Hathern in the Loughborough Rural District had a similar population density to Shepshed Urban District, otherwise the other villages were closer to the overall figure.

acreage resulting from changes made at incorporation in 1888[10]. [Why this did not appear in the 1891 acreage figures is not known.] A better measure of population density is the number of people per unit of habitation. Interestingly, on this score, the County MOH (1903:Table 44) found the overcrowding in the Shepshed Urban District (1.2 per cent) and the Loughborough Urban District (1.1 per cent) in 1903 was only about half that of the Rural District (2.0 per cent).

Table 4.1 draws on MOH data to compare details of estimated population, acreage and persons per acre for the areas within the Loughborough Sub-registration District. The population of the Loughborough Urban District grew by a sizeable 18 per cent between 1891 and 1901 and that of the Shepshed Urban District by an outstanding 20 per cent. This dramatic growth came to a sharp halt in the next decade, especially in the Shepshed Urban District where it was only four per cent. In the Loughborough Urban District it was seven per cent. Such large differences beg the question of how the Medical Officer of Health arrived at his estimates, especially since other errors of a mathematical nature have been noted. This, of course, is not known!

These population figures might lead us to expect that, in line with the theory of the urban–rural gradient, the IMRs in the Shepshed Urban District would be lower than those in Loughborough, but higher than those in the Loughborough Rural District. We might also expect that the dramatic changes in the rate of population growth between the last decade of the nineteenth century and the first decade of the twentieth would also impact on the IMR, especially in the Shepshed Urban District. But in which direction?

---

[10] In 1881, the Loughborough Urban District had a population density of 2.7 persons per acre, in an area of 5,460 acres (Kelly's Directory 1891:733). In 1904, the acreage given was 3,039, of which 40 were water (Kelly's Directory 1904:489). Again, it is not known from where Kelly obtained these figures.

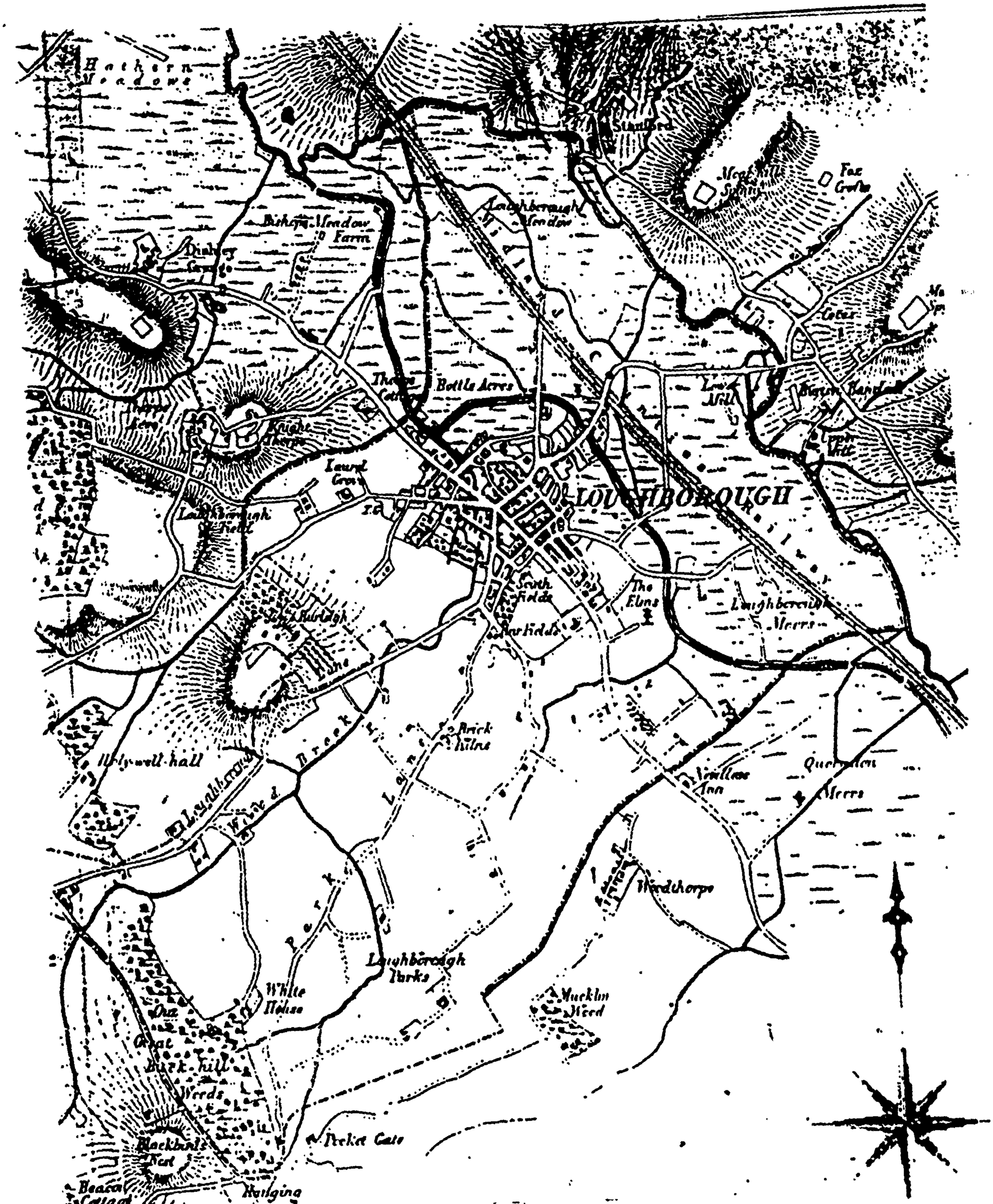


Figure 4.2 Map showing the extent of the flood meadows at Loughborough, Leicestershire

Source: William Lee (1849)

THE GEOLOGICAL CONTEXT

The town of Loughborough (like its near neighbour, the city of Leicester) was located alongside the river Soar, between 40 and 50 metres above sea level (1994: Ordnance Survey Pathfinder Map). The river Soar runs through a floodplain about one and a half kilometres wide. In Figure 4.2 (above) Lee's (1849) map clearly shows the extent of the flood meadows along the north-east side of the town of Loughborough. [On the map, a canal leaves the river Soar near Bishops Meadow farm in the north, passing close by the town, and the Soar continues towards Stamford and passes by on the far side of the flood meadows.] In the Soar Valley[11] the poorly drained soils of the Fladbury series developed on the alluvium have a high clay content and are prominently mottled[12] throughout the profile. The wetness, heavy texture and liability to flooding of the Fladbury series have restricted development on the eastern side of Loughborough. To this day these low-lying meadows flood with river water throughout the year whenever the river bursts its banks at times of heavy rain, and especially in the winter months.

The Soar is a shallow, slow-moving river with a lower gradient than its tributaries, and in the nineteenth century the building of dams for mills and of railway embankments aggravated its sluggish run-off[13]. The quality of its water was causing concern as early

---

[11] Paul (1885:6) explains: The river has excavated for itself a wide valley in the Upper Keuper Marls (gleyed brown rock) and beneath the meadows on either side of the present channel we have a regular series of deposits. Lying in a pan of hard Keuper Marl we have first a varying thickness of rolled gravel, doubtless the remains of the mass which has been removed in the formation of the valley, the marl and sand having been washed away by running water, and the stones left behind in the bed of the stream. On top of this gravel we find several feet of clay, brought down into the valley by freshets from the Keuper and Lias Clays on either side. Upon this grew the trees whose stumps are still embedded in it, and also the water plants and mosses, which formed a thick bed of peat. The peat is buried beneath layers of clay, which gradually rose above the water and formed the surface of the meadows.

[12] Pye (1972:127-8) states 'prominent ochreous mottling below 35 cm (14ins) indicates seasonal waterlogging of the subsoil'.

[13] Frankland found 'percolation through five feet of gravelly soil removes much more organic impurity from sewage water than does a flow of 50 miles in a river at a rate of one mile per hour' (Russell 1996:387).

as 1839, when:

> ...portions of the river...[which]...were limpid and transparent streams, teeming with fish...are now torpid and turbid...an enormous open cesspool of every species of animal and vegetable refuse, in a constant state of decomposition (Elliott 1979:47).

Before the advent of public water supplies, it was common to find rivers used for the collection of water as well as the disposal of waste. In a fast-flowing river this could be effective, at least while populations remained relatively small. However, there is also an unseen hazard to health. River water, and the pollution it carries, is in contact with ground water. The effect of the river Soar, polluted by untreated waste from the Leicester sewers, on the people of Loughborough (and other places downstream) who obtained their drinking water from wells is unknown. Continuing demands for improving the quality of the river water were met by sewage disposal works in Leicester[14] during the 1890s.

The river was not the only hazard to health. Loughborough is sited on keuper marl clay and gravel. These are pervious soils that are often associated with valleys and rivers. Loughborough's surface water, contaminated with organic refuse, easily drained down through the gravel terrace into the groundwater below. The gravel is in pockets, deeper in some places than others, and this allows pollutants, freely and quickly, to saturate the surrounding soil and, more importantly, to contaminate the water table, which was at most 10 feet below the surface. These pollutants might come from, for example, inefficient scavenging of foul waste, drainage from the slaughter of animals for meat, or

---

[14] The County MOH (Medical Officer of Health) wrote: '[I]t is proposed to adopt a system of chemical precipitation and subsidence in tanks, and subsequent filtration of the effluent through beds of polarite' (CMOH 1891:5).

[Polarite, patented in 1889, is a trade name for an insoluble porous mineral containing about 53 per cent of magnetic oxide of iron with silica, lime, magnesia, carbon etc and having the power of absorbing and giving off oxygen. Used in conjunction with ferrozone in the so-called 'international process' of sewage treatment (The Complete Oxford English Dictionary).]

animal waste from stables. In the period of this study there were many small establishments capable of producing such contaminants and much of the population relied on well-water. Well-water could, then, be polluted on two levels, from the surface pollution caused by overflowing cesspools and drains, and from the groundwater. Downing (1998) noted:

> Many farms, households and communities in rural areas still obtain their water supply from shallow wells...because such sources are relatively shallow and often near habitation, they are vulnerable to contamination...(1998:26)...Where many houses are concentrated in a small area, the discharge can lead to contamination of groundwater, in particular by increasing nitrate, sulphate and chloride concentrations (1998:38).

Several authors have commented on apparent locational differences in infant mortality.

Williams (1989) noted the effect on infant mortality of the different sites in Sheffield:

> ...for both infant and child mortality the river areas were generally the most unhealthy in the Borough...In most of the Don valley and the Sheaf valley mortality rates were the highest in the town. For those aged between one and four years, a further area of high mortality in the south-west adjacent to the river Porter is also evident...The most obvious explanation for the high mortality rates in the river areas relates to their geographical situation. Because these areas were low-lying, generally under 200 feet, flat and also relatively badly drained, one might expect water- and food-borne diseases to contribute to the high mortality rates...(Williams 1989:11,110-1).

Munro *et al*[15] (1997) noted differences in Thamesdown, as did Moore[16] (1887), earlier,

---

[15] Munro *et al*'s 1997:11) investigation of soil and drainage conditions in the Swindon area of the Thamesdown District made him '...aware of local differences in human health, including infant mortality, but the reasons for this link between soil moisture and infant mortality are not yet identified or explained in epidemiological terms'.

[16] Moore noted, in a paper he presented to the Leicester Literary and Philosophical Society in 1887, entitled *'The influence of the geological features of a district on the health of its inhabitants'*, that villages were often peopled on gravel-bearing surfaces because these readily yielded good water, and as the villages increased in size it became necessary to supplement the water supply by sinking wells. He wrote:

> [w]ith respect to the influence of soils upon the health of the people living upon them, sandy and gravelly soils are always healthy sites, except when they are low-lying, and thus become water-logged. In soils of this kind a persistently low ground water level is always healthy; a persistently high level is unhealthy, and when the ground water level fluctuates suddenly and considerably, it is more unhealthy still. Low-lying, clayey soils are unhealthy, and favour the development of phthisis, rheumatism, and colds; and with regard to geological strata generally, those which favour the retention of moisture are unhealthy, while those which are dry are healthy sites. If the soil, in addition to being damp, is polluted by leakage from defective drains or cesspools, the bad effect is increased, and such diseases as diarrhoea, typhoid fever, and cholera, are spread amongst the dwellers on such sites...(1887:20-21).

Von Pettenkofer (1818-1901), a German physiological chemist, investigated the sanitary condition of Munich in the mid-nineteenth century, giving attention to the soil and sub-soil water and found three necessary conditions for the spread of cholera and typhoid fever – the presence of the germ in the soil, a

in Leicester. Newsholme (1899:129-213), referring to the core period of this study, admitted the contribution of the soil was not fully understood when he dealt with epidemic diarrhoea in his inaugural address as President of the Incorporated Society of Medical Officers of Health in 1899. However, he suggested:

> The geological characters of a soil can only influence the prevalence of diarrhoea in so far as...its facility for the retention or removal of impurities, by natural or artificial means....Given equal care in scavenging...in different towns, we should expect therefore that the most porous soils would have the most diarrhoea (Newsholme 1899:157).

Newsholme (1899) compared the geological characteristics of thirty-one towns with their infant mortality rates for the years 1882 – 1898. Table 4.2 shows the twelve towns with the worst diarrhoeal mortality records. In the table, the six towns highlighted in red

Table 4.2 *Characteristics of the sites of the twelve towns that experienced the highest levels of infant mortality from 1882 to 1898 in Newsholme's study of epidemic diarrhoea, giving their rating and page reference*

Place in 31 towns	Study page reference	Town	Characteristics
20	193-4	Bradford	sited in basin-shaped hollow
21	194-5	Leeds	soil retentive of moisture
22	196	Liverpool	residential parts on porous pebble-beds
23	196-7	Sheffield	shale & sandstone
24	198	Wolverhampton	no information given
25	199-200	Hull	alluvium; flat; drained by ebb & flow tide only
26	201	Birmingham	porous sand & gravel
27	201-2	Salford	level plain; pervious pebble beds through-out
28	204-5	Blackburn	valley site; one-sixth on sand, five-sixths on clay and gravel
29	205-6	Bolton	valley site
30	207-8	Leicester	in hollow on River Soar; alluvial; subsoil polluted, sewage-sodden; subsoil water 10-15 feet below
31	209-10	Preston	made ground; some alluvial deposit, marshy peat subsoil; subsoil water 10-15 feet below

Source: Newsholme (1899:139-213).

susceptible population, and a soil saturated with organic matter, together with conditions of porosity affected by temperature and moisture or by the rise and fall of the groundwater (Frazer 1850:80-1).

had similar soil characteristics; a further four (shown in blue) occupied valley sites. Of the remaining two towns, one had moisture-retaining soil, for the other no details were supplied. It is interesting that the towns with the worst infant mortality should have similar sites or alluvial and gravel-based geology to the Loughborough Urban District (see chapter 7), although it is not clear what the relationship, if any, would be. Conversely, the geology of the ten towns that experienced less infant mortality featured sand or sandstone to a greater or lesser extent, as did the Shepshed Urban District. Some of these also featured boulder clay (see below).

As part of the Open University Project, Birch (OU 1997:34) found little difference in infant mortality in the Ampthill district of Bedfordshire between parishes on clay, and on sand, although a large difference was found for Flitwick, an area on gravel (see Table 4.3). However, in two-proportion testing, none of these differences were found to be statistically significant at a level of five per cent.

Table 4.3 *Infant mortality on different soils for parishes in the Ampthill Sub-registration District of Bedfordshire*

Aggregated IMR of parishes on clay	Aggregated IMR of parishes on sand	Flitwick on Gravel
108 (50 deaths/459 births)	103 (150 deaths/1443 births)	138 (35 deaths/252 births)

Source: Birch (OU 1997:34).

As we have seen, the settlement of Shepshed lies higher than the town of Loughborough, and the direction of rain, river and ground water flow (close to Ives Head on Figure 4.3 below), is towards Loughborough and into the river Soar. The Ordnance Survey's Geological Survey Map of Great Britain (1950: Sheet 141) shows that the Shepshed Urban District is not a river terrace site. It is partly sited on boulder clay with underlying and overlying sand and gravel, and partly sited on sand and gravel.

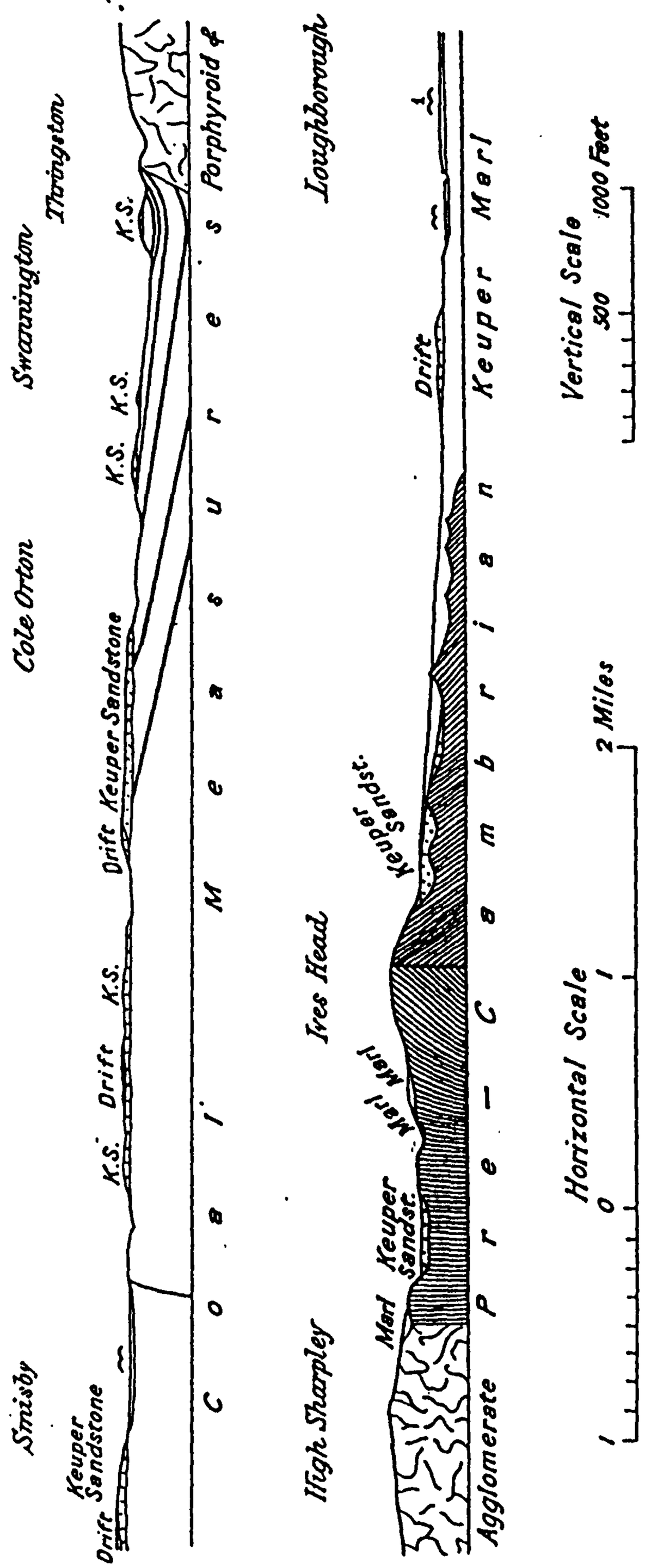


FIG. 1.—Section No. 1, Smisby to Loughborough.

Figure 4.3 *Geological Section covering Shepshed (at Ives Head) to Loughborough*

Source: Richardson (1931:4 fig 1)

It was contemporary belief that sandy and gravelly (except when low-lying) soils were always healthy sites (see footnote 16). The sandy soil may have provided a good natural filtering system[17]. Vaccination data will enable a comparison of infant mortality according to site (see Chapter 6) in the Loughborough Sub-registration District, which will clarify whether or not further investigations would be worthwhile.

There is no doubt that an improved water supply would have made an important contribution to cleanliness, food hygiene, and thus to infant diarrhoeal mortality. There is no direct evidence from vaccination data on this issue, but it will be seen that the changing pattern of infant mortality in the Loughborough Urban District coincided with the opening of a new reservoir. Water data is scarce, but records do exist of samples taken at two different times at the time when the new reservoir came into use (Table 4.4 above). In 1906, the new reservoir had been in use for only a few months. The analysis of the sample taken nine months later, in October 1907, showed a much lower level of nitrate in the water, indicating a much lower level of bacterial pollution[18]. This may

---

[17] Sand is the medium used by waterworks in Britain for the filtration of water from about 1829:

> [a]fter use a jelly-like deposit is formed on the top of the sand...that film has prevented water getting through the filters at the ordinary vertical rate of 4-6 inches an hour. It is the effective agent in filtering the water, for the organic slime destroys the micro-organisms which are in impure water (Browne 1911a:215).

Sand only makes a difference in the bacteriological, not chemical, analysis of water. Browne's subsequent article (1911b:216) describes a sample of Thames water at Hampton, which contained 1644 micro-organisms in 20 drops of water. After passing through sand filters, only 13 such organisms in the same number of drops remained. Places with a sandy soil would benefit, therefore, from a natural filtration of their groundwater, and this would be especially important when water from wells was the main source of supply. This natural cleaning process would be effective in those places where wells were either of sufficient depth or distance from sources of contamination, or where the 'organic slime' or any other strata with similar properties, was present to reduce the speed of filtration.

[18] Gelberg (1999:40) noted that '[o]ften when high nitrates are present, other contaminants, particularly coliform bacteria, are also present.' The purpose of analysing water for its nitrate content was to discover the presence of bacteria. Nitrates could be determined in water at least by the last decade of the 19th century - see A H Gill's (1894 XVI: 122-132) article in the Journal of the American Chemical Society 'On the determination of nitrates in potable water'. However, "chemical" measurements as a guide to epidemiological changes have now been superseded by microbiological analysis which can tell us very

Table 4.4 *Richardson's analysis of Loughborough's new reservoir - 1906 and 1907*

	Near Dam	Top end of Reservoir	Reservoir
Date	24th January 1906	24th January 1906	8th October 1907
		Parts per 1,000,000	
Organic Carbon	6.16	3.57	4.60
Organic Nitrogen	0.51	0. 34	0.32
Ammonia, free & saline	0.24	0. 04	Nil
Nitrogen as nitrate*	2.58	2.72	0.18
Total combined nitrogen	3.29	3.09	0.50
Combined Chlorine	17.5	18.0	15.0
Hardness – Temporary	20.0	50.0	80.0
- Permanent	120.0	115.0	93.0
- Total	140.0	165.0	173.0
Total Solid Residue	248.0	246.8	239.4

* Nitrogen as *nitrites* was listed separately in this analysis. Nil was found in all three samples.

Source: Richardson (1931:127) Analysis by William T Burgess.

provide some explanation as to why it was at this particular time that infant mortality fell in the Loughborough Urban District, although neither the extent nor the speed of installation of piped water to properties in the area are known. However, we do know that the Shepshed Urban District, which did not have a similar fall in infant mortality, experienced problems in obtaining a water supply from the Loughborough waterworks at least until the end of the present period of study.

THE DEMOGRAPHIC CONTEXT

Table 4.5 gives Lee's (1991:57) IMRs for Leicestershire, together with those for the Loughborough Sub-registration District based on the Registrar-General's *Quarterly Returns.* The pattern is similar for both areas, although the rise in the IMR from the early 1880s to the early 1890s is barely perceptible in Leicestershire. This increase,

much more about the latter issues than was possible at the time of the opening of the reservoir in Loughborough.

appearing more clearly in the Loughborough Sub-registration District, was a common pattern found by Lee (1991:59) in his regional comparisons[19]. Leicestershire had one of the highest county rates of infant mortality according to Lee (1991:56), although in other ways it did not stand out. For instance, its pattern of change from decade to decade was the same as that of 40 out of the 55 counties studied by Lee, in having its peak rate in either 1861 or 1871 (Lee 1991:59).

Table 4.5 *Infant mortality rates (as a 3-year average centred on the first year of the decade) - Leicestershire and Loughborough 1871-1901*

	1871	1881	1891	1901
Leicestershire	185	165	166	148
Loughborough Sub-registration District	182	151	161	151

Source: Leicestershire: Lee (1991:57); Loughborough: figures compiled from the Registrar-General's *Quarterly Returns of Marriages, Births and Deaths registered in divisions, counties and districts of England & Wales,* London HMSO, by Professor Michael Drake (unpublished paper).

There are, however, several problems with Lee's analysis. First, a great deal of weight is put on the mean of a particular three years. For instance, the mean IMR for the Leicester Registration District in the years 1899-1901 was 14 per 1000 less than that for 1900-02. Second, much can happen in the mid-decadal years – and did! – which is missed by Lee's method of analysis.

The annual IMRs for Loughborough, Leicester and England from 1871 to 1910 are given in Appendix 3[20]. During the forty years from 1871 to 1910, the annual IMRs in

[19] Lee (1991:56-7) found a varied pattern of change in individual counties that was 'neither a uniform decline nor a marked hiatus at the turn of the century'. These regional variations contrast with the national picture; as we can see from Figure 4.4 in England, infant mortality appears to decline from the turn of the century.

[20] The usual method of comparison of infant mortality between two cohorts or places is to calculate an infant mortality rate, which is a proportion of the number of infant deaths per 1,000 live births. A computer program was used to calculate a standard two-proportion test, in order to assess the significance

Loughborough were significantly different to those in England in *only* eleven years. In Leicester, however, the annual IMRs were significantly different from those in Loughborough in all *except* thirteen years. This is not unexpected in that the Loughborough Registration District, like England as a whole, was made up of a mixture of urban and rural areas, whilst Leicester was a major industrial city. To overcome the problem of reading too much into a pattern of IMRs based on the average of the first three years of each decade, and to make it easier to see than in a graph of annual readings, a three-year moving average of these IMRs was calculated.

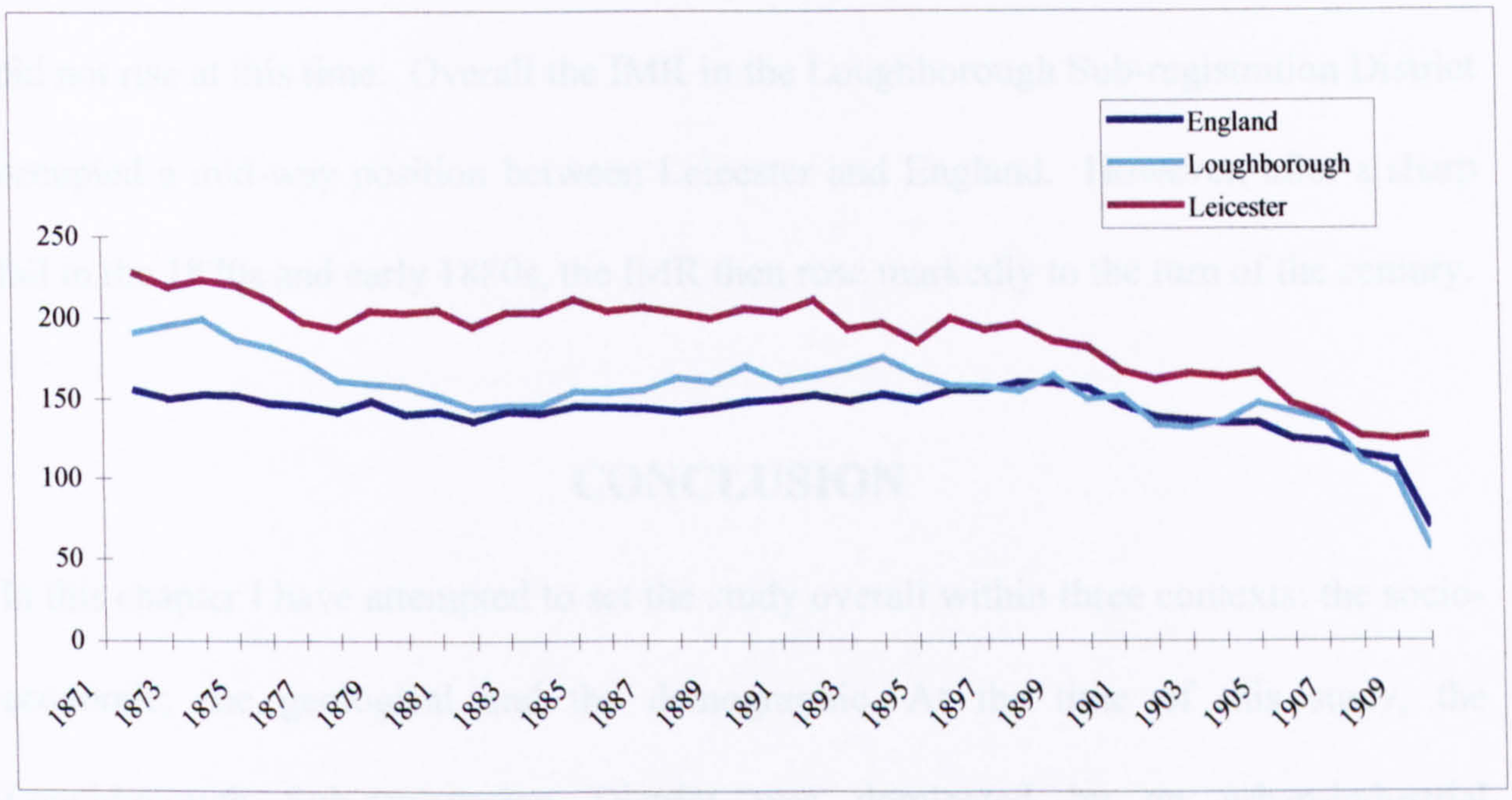


Figure 4.4 Infant mortality rates in England, Leicester and Loughborough 1871 – 1910, calculated with a three-year moving average (The first average calculates the years 1871-73)

Source: The Quarterly Returns of the Marriages, Births and Deaths of England by the Registrar General; Leicester figures compiled by the author, those for Loughborough and England by Michael Drake (unpublished paper).

Figure 4.4 shows infant mortality in England was remarkably stable in the last quarter of the nineteenth century at around 150 per 1000, as noted above. The city of Leicester

---

of differences in the IMR for cohorts that had substantially different numbers of births. If differences were found to be significant at a level of five per cent, it would indicate that they had not occurred randomly by chance, but were part of a systematic change. Nearly all the differences shown in Appendix 3 proved to be significant in one respect or another.

experienced consistently higher infant mortality rates than England at just over 200 per 1000. Its rate was comparatively stable too and showed no signs of a rise in the 1890s. Quite the contrary, the rate appears to have begun its secular decline at the beginning of this decade. This is especially interesting as Leicester had one of the highest IMRs in the country, one reason, no doubt, why it was chosen by Ogle when making his urban-rural comparison of IMRs (see below). Also it had been notorious for its extremely high diarrhoeal death rate. Since the rise of the IMR nationally in certain years in the 1890s has been put down to a sharp rise in deaths from diarrhoea, the consequence of some hot, dry summers, it is, on the face of it, somewhat surprising that the IMR in Leicester did not rise at this time. Overall the IMR in the Loughborough Sub-registration District occupied a mid-way position between Leicester and England. However, after a sharp fall in the 1870s and early 1880s, the IMR then rose markedly to the turn of the century.

CONCLUSION

In this chapter I have attempted to set the study overall within three contexts: the socio-economic; the geological and the demographic. At the time of this study, the Loughborough Sub-registration District was dominated by an urban-industrial population. By the end of the nineteenth century, some 80 per cent of its population was living in its two urban centres. This mirrored the situation in England[21] almost exactly. A comparison of the changes in the IMR in the late nineteenth century also shows a close fit between those of the Loughborough Sub-registration District and England as a whole. *A priori*, these two patterns (the socio-economic and the demographic) would seem to be linked.

---

[21] Woods (2000:360) calculated that the percentage of the national population living in urban places in England and Wales was approximately one-quarter by 1751, half by 1851 and three-quarters by 1901.

It seems possible, therefore, that by using the individual level data supplied by the vaccination registers of the Loughborough Sub-registration District, we may get some understanding of the national picture, although that is not the primary purpose of this study. The geological context has been provided because infant mortality rates appeared to reflect differences in habitation sites and the installation of a new reservoir within the sub-registration district.

5

Urban-rural differences in infant mortality: Loughborough 1888-1910

In this chapter I investigate the urban-rural[1] gradient at a level beneath that of the registration district (Woods 1995) or registration county (Lee 1991)[2]. My research is based on vaccination data for the three administrative areas that form the Loughborough Sub-registration District, together with material taken from various MOH reports. I begin by using these two sources to calculate intra-district infant mortality rates. Interesting differences emerge. I then go on to see what is to be learned from the MOH reports of cause of death. Prior to 1900 the information is sporadic. After that date, however, aggregate cause of death data for the three districts is available annually. I have used this in two ways: first to trace annual changes in the three districts of the main causes of death from 1900-1911 and second to compare the number of deaths

---

[1] Urban-rural differences are important because, as Woods *et al* (1993:41) observed, England was 'an overwhelmingly urban country' compared to some European countries. Williams and Galley (1995:403) noted: 'even the most rural of counties – although experiencing lower than average levels of infant mortality – contained market towns, some of considerable size, yet the behaviour of infant mortality in these places in relation to their immediate hinterlands is unclear.' These differences were not new; Woods, Williams and Galley (1993) found differences before 1750 and between rural parishes and market towns. 'Seventeenth century levels within individual parishes varied from 90 per 1,000 live births for the isolated rural parish of Hartland to 222 per 1,000 live births for the small market town of Gainsborough (Woods et al 1993:37)'.

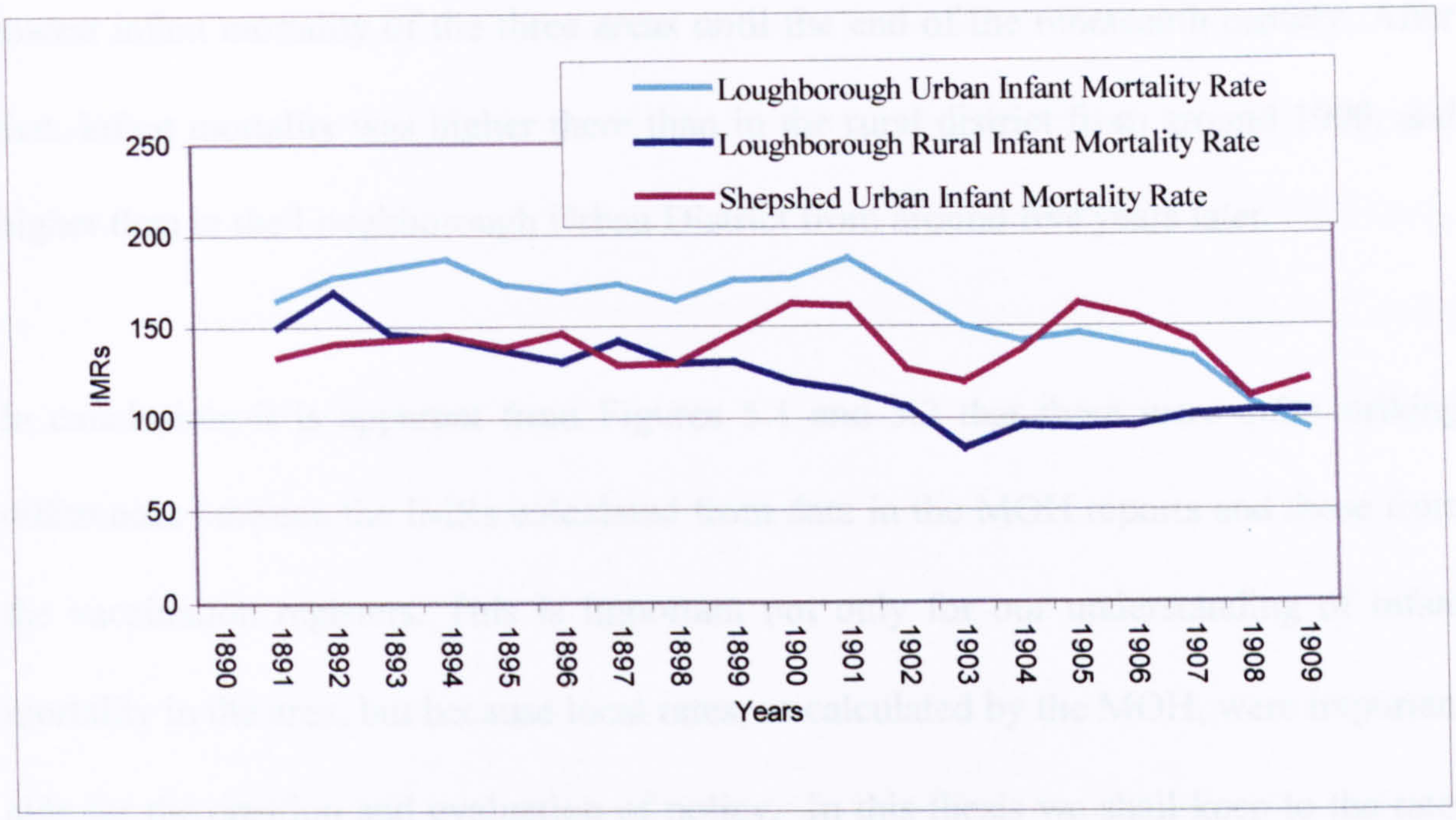
[2] Previously, annual IMRs at local district level have only been available from *Medical Officer of Health Reports*, but such rates are not totally reliable, as discussed above, and it is not possible to break down the data to access information for the small villages or suburbs that may be included within the districts. Sources previously used by demographers include the Registrar-General's *Annual Reports* and *Quarterly Returns* as well as the *Decennial Supplements.* The *Decennial Supplements* are limited, being unable to show intra-decadal patterns; the *Annual Reports* from 1837 – 1894 do not give details below the level of the registration districts; the *Quarterly Returns* give the details for sub-registration districts, but re-grouping this data can be problematic because, as Mooney (1994:146) points out, the areas of provincial towns do not necessarily correspond to the registration district.

from the three main diseases before and after the sharp fall in the IMR i.e. between 1900-06 and 1907-10. The fall in deaths from diarrhoeal diseases is clearly the dominant one.

INTRA-DISTRICT INFANT MORTALITY RATES

Both MOH and vaccination register sources provide us with IMRs for the three constituent administrative areas of the Loughborough Sub-registration District. Beginning with the years 1890-92, these rates are shown as three-year moving averages. There is a difference in the method of calculating the rates presented in Figures 5.1 and 5.2. In the former, period rates are used i.e. they are derived from the number of births and infant deaths registered in the same year. In the latter, cohort rates are used i.e. the deaths of infants relate directly to the birth cohort from which they come. It is also clear from Figures 5.1 and 5.2 that, while the rapid secular decline occurred in the Loughborough Urban District from the turn of the century according to MOH data, the decline began in the mid-1890s according to vaccination registration data.

In the rural district of Loughborough, the IMRs derived from the vaccination registers are generally higher than those based on the MOH reports, although they are still consistently lower than the Loughborough Urban District, except for a short period in the early 1890s. The apparent anomaly centred on the year 1893 and is probably because the data from the MOH reports is missing for the year 1892. The County MOH reported that the increased infant mortality in 1893 was mainly due to infantile diarrhoea, for which he blamed the prolonged period of hot weather in the summer and autumn. This was true nationally (Woods 1988). The three-year moving averages calculated from vaccination data show that the Shepshed Urban District experienced the



Note: No MOH Report exists for Loughborough Rural District in the year 1892; County MOH reports began in the year 1890.

Figure 5.1: A comparison of infant mortality rates for the Loughborough Urban, Loughborough Rural and Shepshed Urban Districts calculated with a three-year moving average from 1891 to 1909, starting with the years 1890-92.

Source: Compiled from MOH reports (unreferenced at Leicestershire Area Health Authority).

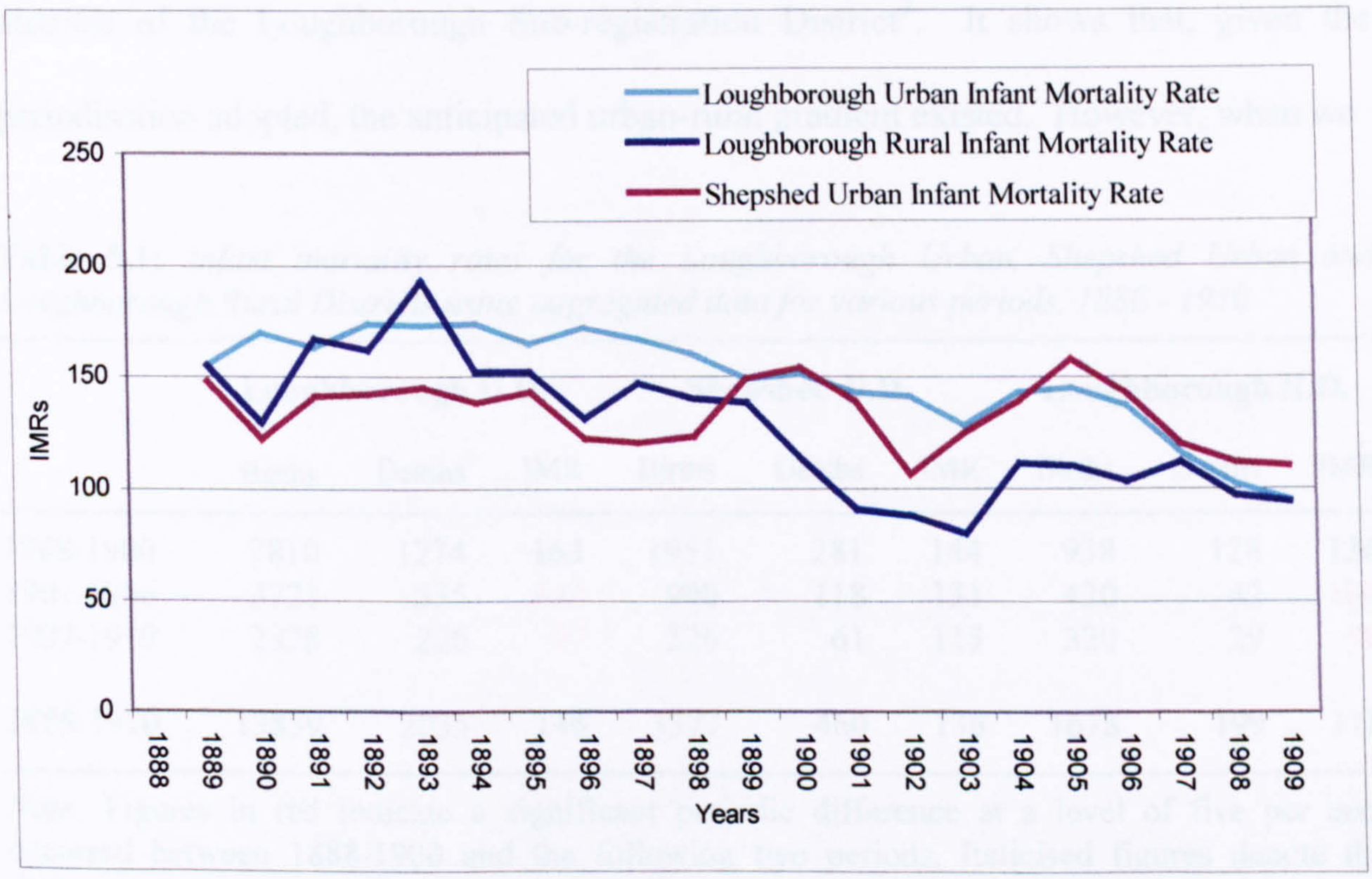


Figure 5.2 A comparison of infant mortality rates for the Loughborough Urban, Loughborough Rural and Shepshed Urban Districts calculated with a three-year moving average from 1889 to 1909 (The first year calculates 1888, 1889 and 1890)

Source: Compiled from Vaccination and Infant Death Registers.

lowest infant mortality of the three areas until the end of the nineteenth century. After that, infant mortality was higher there than in the rural district from around 1900, and higher than in the Loughborough Urban District from around five years later.

In conclusion, it is apparent from Figures 5.1 and 5.2 that there were quite striking differences between the IMRs calculated from data in the MOH reports and those from the vaccination registers. This is important not only for our understanding of infant mortality in the area, but because local rates, as calculated by the MOH, were important aids for the creation and evaluation of policy. In this thesis we shall keep to the rates calculated from the vaccination register data, principally because being cohort specific they are likely to be the more accurate.

Table 5.1 presents the births, infant deaths and IMRs for the three administrative districts of the Loughborough Sub-registration District[3]. It shows that, given the periodisation adopted, the anticipated urban-rural gradient existed. However, when we

Table 5.1: *Infant mortality rates for the Loughborough Urban, Shepshed Urban and Loughborough Rural Districts using aggregated data for various periods, 1888 - 1910*

	Loughborough U.D.			**Shepshed U.D.**			**Loughborough R.D.**		
	Births	Deaths	IMR	Births	Deaths	IMR	Births	Deaths	IMR
1888-1900	7810	1274	**163**	1951	281	144	938	128	**136**
1901-1906	3721	535	***143***	900	118	131	420	42	**100**
1907-1910	2328	226	***97***	526	61	115	320	29	**90**
1888-1910	13859	2035	146	3377	460	136	1678	199	118

Note: Figures in red indicate a significant periodic difference at a level of five per cent occurred between 1888-1900 and the following two periods. Italicised figures denote the difference between the two periods in the 20th century was also significant.

Source: Compiled from Vaccination and Infant Death registers.

[3] Appendix 4 gives the annual births, deaths and IMRs for the Loughborough Sub-registration District and its constituent urban and rural districts from 1888 to 1910.

examine year-on-year IMRs (Appendix 4), the expected gradient of the three areas occurred in only 5 of the 23 years from 1888-1910. Thus, annual data reveal a complexity that is hidden by the aggregate data. The most unexpected distinction appeared between the two urban districts. The IMR for the Shepshed Urban District was lower than that of the Loughborough Urban District for almost all of the period 1888-1900, but because it did not decline thereafter, the situation was reversed.

A two-proportion test was used to test for statistical significance in the difference between the IMRs of these three areas. Between 1888-1910, the difference between the two urban districts proved to be significant in only four years, 1888, 1889, 1893, and 1895, and between the rural and urban districts of Loughborough in only three years, 1892, 1902 and 1909. This casts some doubt on the conclusions drawn above. Because of this I will now attempt to explain the differences in the IMRs in those years when such differences proved to be statistically significant.

CAUSES OF DEATH

There are two main problems with MOH Reports from the 1890s for a study of infant mortality such as this: accuracy and detail. Usually the total number of deaths from a particular disease is stated, and if further detail is given, these are attributed to *mainly* under-one-year olds. In 1903, Dr T Robinson, the Medical Officer of Health for the County of Leicester said:

> The difficulty of obtaining the information necessary to fill in these columns is by no means light and I endeavour to get the totals for the Urban and Rural Districts and the whole county as accurate as possible. Even then it is almost certain that the return is not correct[4], but the inaccuracy will not materially affect the value of the statistics for the County.

[4] Dr Corcoran (1897:21) reported: 'The low rates of [all-age] mortality in the urban districts as compared with that in the rural districts is probably owing...to...its being based upon estimated population and is an argument in favour of a quinquennial census.'

Dr Robinson does not tell us how great was the inaccuracy, and how he judged it to have no effect on the statistics. Neither can *we* judge the effect on statistical significance. While being grateful for his honesty, his declaration adds weight to the writer's opinion, discussed in Chapter 3, that we cannot place too much reliance on the MOH figures that do exist. Because of this, we should perhaps give more weight to what was said in the Reports rather than the figures given in them.

There are many disparate comments in the MOH Reports, but there are also some main issues running through them. In the 1890s, the MOHs had very similar things to say about the causes of death that occurred in the areas of the Loughborough Sub-registration District. The infectious diseases of measles, whooping cough, scarlet fever, erysipelas and autumnal diarrhoea visited the areas in most years with varied strength. Typhoid and smallpox were also reported but infants under one year do not feature in these outbreaks. Puerperal fever, blamed on the unhygienic practices of midwives, affected the mother in childbirth but only indirectly affected the infant. Various causal factors for the town's poor health are named: the Reports discuss poor drainage, the flushing of sewers[5], the quality of the scavenging and the water supply. The severe and changeable winter weather was blamed for respiratory diseases, and the hot and dry weather for gastro-intestinal complaints. Parents received their share of the blame, too. In 1905, infant mortality was allegedly the fault of ignorance of the rudiments of feeding and care of infants, premature birth and neglect. Female labour was deemed to be responsible for much of this (CMOH 1905:25), and for mothers sending infants of three and four years of age to infant school (CMOH 1910:19). This was also seen early on in the Reports. In 1890, Mr Corcoran (CMOH 1890:4), MOH for the Loughborough

[5] The old brick culvert sewers suffered through insufficient fall i.e. they were too level.

Urban and Rural Districts, suggested 'the high infant mortality [wa]s attributed to the baneful influence of factory life'. He continued:

> Autumnal Diarrhoea caused nineteen deaths, chiefly among infants. Three main factors are recognised as its causation, viz., heat, polluted subsoil, and a sudden fall in the level of the subsoil water, which is normally too high....Phthisis, Rheumatism, and Heart Disease are very prevalent, and are attributed to the height of the subsoil water, and as a means of dealing with this condition a Soar Valley Main Drainage scheme is suggested (see pp70-71).

In 1892, he (CMOH 1892:6) complained of:

> the prejudicial effects of the existing filthy middens, constructed of porous materials, allowing percolation into the surrounding soil, thus directly and indirectly polluting the air in their neighbourhood...such an atmosphere is not conducive to health....it is the cause of a large portion of the sickness and mortality which exist in children under one year of age...unless the people themselves practice domestic, personal, and moral cleanliness, municipal sanitation will never be able to stamp out infectious diseases.

There was a notion that infant diarrhoea was attributable to the inhalation of gases exhaled from filth saturated surface soil of towns in warm weather[6]. While the Shepshed Urban and the Loughborough Rural Districts experienced similar cycles of infectious disease, neither saw the large amount of infant mortality from diarrhoeal disease that occurred in the Loughborough Urban District.

During this decade, parents received leaflets on the care of infants and the symptoms of infectious diseases; milk from tubercular cows was banned from human consumption; the Highways and Sanitary Committee began to supervise all connections to sewers, which were then only performed by their own workmen; the Loughborough Urban District improved its sewage disposal system; and the virulence of scarlet fever diminished, although this made t he disease more difficult to detect (CMOH 1890-1899). The Sanitary Committee in Loughborough was active in reducing middens,

---

[6] It was not until 1908 that the true connection was reported: 'Some observers have recently proved to what a large extent flies are responsible as carriers of filthy decomposing matter from such places as ash-pits, privies, manure and other filth accumulations, to the food-stuffs of infants. It is, therefore, all the more important that there should be no filth accumulations permitted near to dwelling houses and that scavenging...should be more frequently and thoroughly done in the summer than in the winter' (CMOH 1908:27).

removing accumulations of filth, improving paving in yards and courts, supervising house drains and sewers and circulating handbills at the beginning of the hot season. The pan system (of providing privies with pans that could be emptied weekly) was reported to be unsatisfactory and householders were urged to burn as much refuse as they could on the kitchen fire. The MOH reported that the majority of infant diarrhoeal deaths occurred in courts and back-to-back houses, and the Unhealthy Dwellings Sub-committee was active in condemning many houses in the worst areas. The Leicester and Leicestershire Branch of the National Association for the Prevention of Consumption was also working with the Sanitary Authorities in the County of Leicester. In Loughborough and Shepshed there were problems with summer droughts and plans were initiated to monitor the water supply[7] and for a new reservoir. A new sewage disposal works had been in place in Loughborough from October 1894.

In the 1900s, new houses were being built in both the urban districts and further improvements to their sewage works were being implemented[8]. In 1900 the MOH reported a continuing problem in the Shepshed Urban District with unsatisfactory scavenging and this coincided with an unusual number of cases of diarrhoeal diseases and five deaths of under-one-year olds. The Council was busy installing a water main in preparation for the supply from the Loughborough Corporation's new reservoir, and achieved 102 connections by 1910. If these were connections to individual homes, then it seems the process was fairly slow. Fewer infant deaths in 1901 were seen, somewhat prematurely perhaps, as an indication of an improved sanitary condition of the borough

---

[7] Dr Corcoran (1897:8) commented: 'A minute survey of the water-shed and careful supervision of possible sources of contamination is more valuable than the occasional chemical analysis.'

[8] In 1903 Loughborough Town Council was congratulated by the County MOH for almost eradicating typhoid fever. Typhoid Fever was seen to recur on the emptying of privy middens, and in 1905 one epidemic was traced to a faulty milk supply.

(CMOH 1901:19). In 1904 enteric fever in the Shepshed Urban District was traced to polluted well water[9]. The MOHs made no connection between the droughts in the summer months and the increases in summer diarrhoea in those same months.

Dr Bell, MOH for the Shepshed Urban District complained that parents did not recognise symptoms of infectious diseases, and convalescent children were allowed to play in the street before being free of infection, and in this way epidemics were encouraged. He had tried to impress upon parents that measles and whooping cough were serious for young children and recommended 3-5 year olds be excluded from schools, but it is not known if this was achieved. By the end of the decade, however, parents had come to appreciate the seriousness of whooping cough.

In 1906 there was an increase in diarrhoeal deaths. It was recommended that all privy middens and pail closets be abolished and that neglected back gardens should be paved, rather than be used for receiving filth and rubbish that produced a nuisance in hot weather. In 1907 there was a large reduction in summer diarrhoea. It was suggested that the lack of hot weather, and improvements in the domestic life of the working classes, was responsible, together with the better feeding and nursing of infants and the sanitary condition of houses. At this time the Shepshed Urban District still experienced unsatisfactory scavenging.

During the decade, factories and workshops began to be inspected, as were dairies, cows and milk shops, in all three areas. However, in 1905 the MOH for the Shepshed Urban District reported that the conditions in which milk was delivered were

---

[9] Dr Bell, MOH for the Shepshed Urban District reported: 'the bacteriological examination of the water showed the degree of general bacterial impurity...is very considerable' (CMOH 1904:53).

sometimes truly disgusting (CMOH 1905:33).

While infectious diseases still appeared in epidemic form, there formed a realisation in the Loughborough Urban and Rural Districts that a decrease in infant mortality had begun. A table of causes of death in 1908 (CMOH 1908:11) showed that while premature birth accounted for a large proportion of the deaths of infants in the urban districts, the biggest category was other wasting diseases. This pattern was repeated in the rural districts and in the county overall. The MOH commented (CMOH 1908:12) that 'other wasting diseases, many of which are due to faulty nursing and feeding, and are preventable, have also increased.' In 1910, Health Visitors were giving lectures, for example, on 'The Feeding and Care of Infants'. In the same year Dr Robinson (CMOH 1910:14-15) noted that summer diarrhoea was much less prevalent and fatal, and there were the 'most marked improvements in wasting diseases and convulsions'[10]. Following Bayes' argument (see p.8), then, our prior knowledge that infant mortality did decrease at a certain point of time in the area of study, taken in the context of what the MOHs considered to be important, that is, improvements to sanitation and water, may indicate what we should consider to be the causal factors. Can we then substantiate this by a more specific analysis of the cause of death data?

To fully explain changes in infant mortality, analysis of the cause of death is required. Unfortunately, vaccination registers do not have this information and, as mentioned above, MOH records provide only limited details. The same applies to the cause of death data from 1890 in the *Summary of Annual Reports* of the Medical Officers of

[10] The systematic scavenging of privies and pails is of the first importance. Such scavenging is not carried out when left to the individual. Wherever a public scavenger is provided the health of the district has invariably improved (CMOH 1910:15).

Health in Leicestershire, compiled by the County MOH. Some comments from this last mentioned source have been abstracted to give an indication of what was thought to be important to report at that time (Table 5.2).

Table 5.2: *Medical Officer of Health information for the years when a significant difference occurred between infant mortality rates in the areas of the Loughborough Sub-registration District*

Year	Loughborough Urban District	Shepshed Urban District
1888	No report available	No report available
1889	No report available	No report available
1893	8 infant deaths – whooping cough 39 mostly infant deaths – diarrhoea 25 children motherless after two outbreaks of puerperal fever	1 death – whooping cough
1895	26 deaths of children under 5 = diarrhoea	Measles epidemic. No infant details

Year	Loughborough Urban District	Loughborough Rural District
1892	140 cases scarlet fever	Infant mortality low
1902	10 infant deaths – whooping cough 2 infant deaths – measles 5 infant deaths - diarrhoea	0 infant deaths – infectious disease 3 infant deaths – bronchitis 42 cases diphtheria
1909	4 infant deaths – whooping cough 1 infant death – diphtheria, measles 16 infant deaths - diarrhoea	0 infant deaths – infectious disease 1 infant death – bronchitis County rural infant mortality lowest on record

Source: County Medical Officer of Health Summary Reports for Leicestershire.

Vaccination data suggest that in the Loughborough Urban District infant mortality was higher in 1893 by 16 deaths per 1,000 births than in 1892. This was a year of high infant mortality in the country as a whole (Woods and Shelton 1997: 48). Mr Thomas Corcoran (CMOH 1893:6), the Medical Officer of Health for the Loughborough Urban District, attributed high mortality at all ages in 1893 to:

> severe and changeable weather at the beginning and end of the year being productive of respiratory diseases, and the very hot dry weather being conducive to gastro-intestinal complaints.

The Shepshed Urban District, just a few miles away, must have experienced similar weather yet infant mortality was lower there by 21 deaths per 1,000 births in 1893 than

in 1892! How can we explain this somewhat surprising difference? In his 1892 MOH Report for the Shepshed Urban District, Doctor G. Cardno Still (CMOH 1892:8) noted that one method of combating a virulent outbreak of diarrhoea in September that year was to boil all drinking water and milk. It is not known if this method was advocated, or, if advocated, adopted in the Loughborough Urban District, although Mr Corcoran (CMOH 1892:6) commented in his MOH Report for that district also in 1892:

> [u]nless the people themselves practice domestic, personal, and moral cleanliness, municipal sanitation will never be able to stamp out infectious disease.

In 1893, the number of deaths per 1,000 births for the Loughborough Urban District was 185 compared to 160 for all urban districts in the County of Leicestershire. The number of deaths per 1,000 births for the Shepshed Urban District was 113, a comparatively low rate at that time. Yet Dr. Still (CMOH 1893:8) comments on the unusual amount of sickness in the year! Another apparent contradiction in the Loughborough Rural District, in 1892, was that infant mortality was low despite a serious measles epidemic in July (CMOH 1892: 11) (see table above). There are other, real, contradictions in the Reports: for example, in 1893 Mr Corcoran (CMOH 1893:12), who was also the MOH for the Loughborough Rural District, suggested the sudden increase in infant mortality was due to autumnal diarrhoea, although previously he had reported that no particular increase of diarrhoea occurred at that season (CMOH 1893:7). Such disparities may have arisen because some parts of the MOH reports were simply repeated on a yearly basis[11].

Mr Corcoran (CMOH 1895:8) reported that an extensive outbreak of measles in the Loughborough Urban District began in October 1895 but deaths from measles and respiratory diseases did not escalate until the weather grew colder. It is not known if

---

[11] My thanks go to Dr G Mooney for this information.

any of these deaths were of infants. Vaccination register data for the two urban districts record only fifteen infant deaths in November and December 1895 (Table 5.3)[12].

Table 5.3: *Age at death for infants dying in the Loughborough and Shepshed Urban Districts - November and December1895, January and February 1896*

Age at Death	Number	Place of Death
November 1895		
8 months	1	Loughborough
9 months	1	Loughborough
11 months	2	Loughborough
Total	*4*	
December 1895		
12 days	1	Shepshed
21 days	1	Shepshed
1 month	1	Loughborough
2 months	1	Loughborough
3 months	1	Loughborough
4 months	1	Shepshed
5 months	2	Shepshed, Loughborough
6 months	2	Loughborough
10 months	1	Loughborough
Total	*11*	
January 1896		
5 months	2	Loughborough, Shepshed
6 months	1	Loughborough
7 months	1	Loughborough
10 months	1	Loughborough
Total	*5*	
February 1896		
1 hour	1	Loughborough
6 hours	1	Loughborough
12 hours	1 (a twin)	Loughborough
18 hours	2 (twins)	Shepshed
24 hours	3 (triplets)	Loughborough
1 day	1 (a twin)	Loughborough
2 days	1	Loughborough
3 days	1	Loughborough
7 days	1	Loughborough
21 days	1	Loughborough
2 months	1	Loughborough
4 months	2	Loughborough, Shepshed
7 months	1	Loughborough
10 months	1	Loughborough
Total	*18*	

Source: Infant Death Registers

[12] It is not intended that any wider conclusions for England as a whole should be inferred from this small-scale analysis.

The monthly average for the whole sub-registration district was little more than twelve in that year so it seems unlikely that this epidemic impacted on *infant* mortality. The age at death, given in the infant death register, shows that two of these infants, both from Shepshed, had an age given in days; they are, therefore, more likely to be attributable to prematurity. Other causes of death are not age specific. In Great Britain, the colder, winter weather usually continues into January and February. In 1896 the average number of infant deaths per month was eleven, but in January there were only five infant deaths recorded in the vaccination register. However, there were eighteen infant deaths in the following month. Seven of the deaths were from multiple births, and a further five or possibly six deaths that occurred only a few days after birth could be attributed to prematurity. Even if all of the remaining five deaths were due to measles or ensuing complications, this would mean that less than one third of the deaths in 1896 were possibly due to the epidemic.

In 1902, the District MOH for the Loughborough Rural District reported that the IMR was below average and that although more cases of infectious disease occurred during that year there were fewer deaths. In 1909, the County MOH reported infant mortality in the county was the lowest on record. In that year it seems the experience of the Loughborough Rural District was a reflection of the larger picture, although this is perhaps all the more remarkable as the rapid secular decline of infant mortality in the urban district of Loughborough had begun two years previously. In the rural district there were few deaths from diarrhoeal or infectious diseases in the twentieth century, although this does not necessarily mean the incidence of disease was any less.

In his Report for 1911, the Registrar General analysed urban-rural differences by cause

of infant death. He observed that measles and diphtheria followed the usual rule of urban excess, but in the first six months of life whooping cough caused higher mortality in the rural districts. He found respiratory diseases, diarrhoea, syphilis and overlying were all more common fatalities in urban conditions, while congenital malformations, premature birth and the wasting diseases differed little whatever the area. Our data for the Loughborough Sub-registration District does not tell us whether or not a similar pattern of disease occurred there. However, from this survey of MOH Reports it has to be concluded that the amount of sickness during the year was not related to the number of deaths. Although, then, the vaccination registers bring us tantalisingly close to a complete understanding of infant mortality, by supplying, at the level of the individual infant, dates and ages at death, our ambitions are frustrated because they do not give us the cause of death, and because the MOH reports do not wholly make up for that shortfall.

MOH ANALYSES OF THE CAUSES OF INFANT DEATHS 1900-11

Table 5.4, taken from the 42nd Report of the Local Government Board dated 1912-1913, compares the mortality experience of the Loughborough Urban District with the

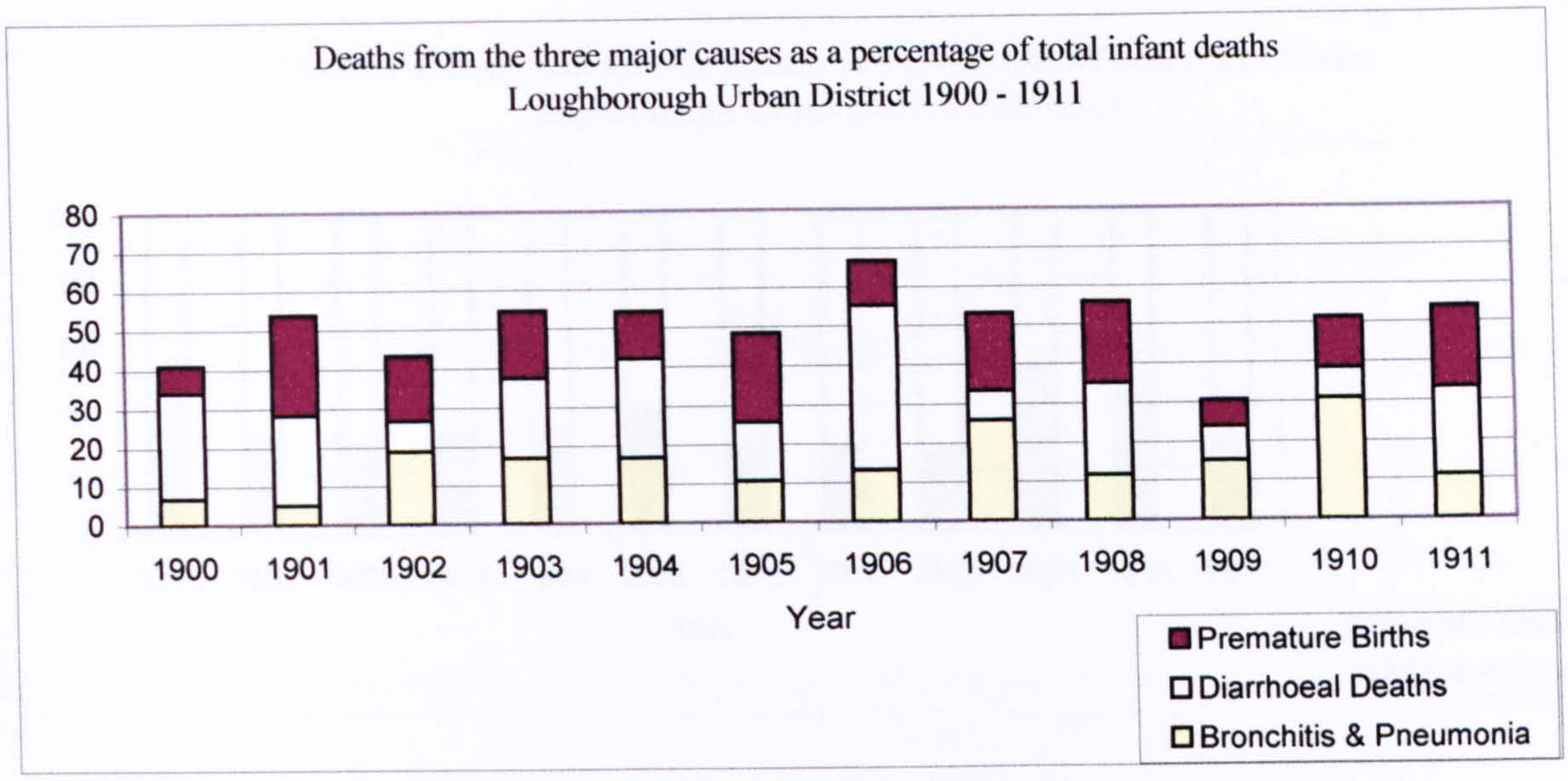
Table 5.4 *Mortality of infants in Loughborough by age and cause of death, compared to the average experience in 241 urban areas in England and Wales, 1907-1910*

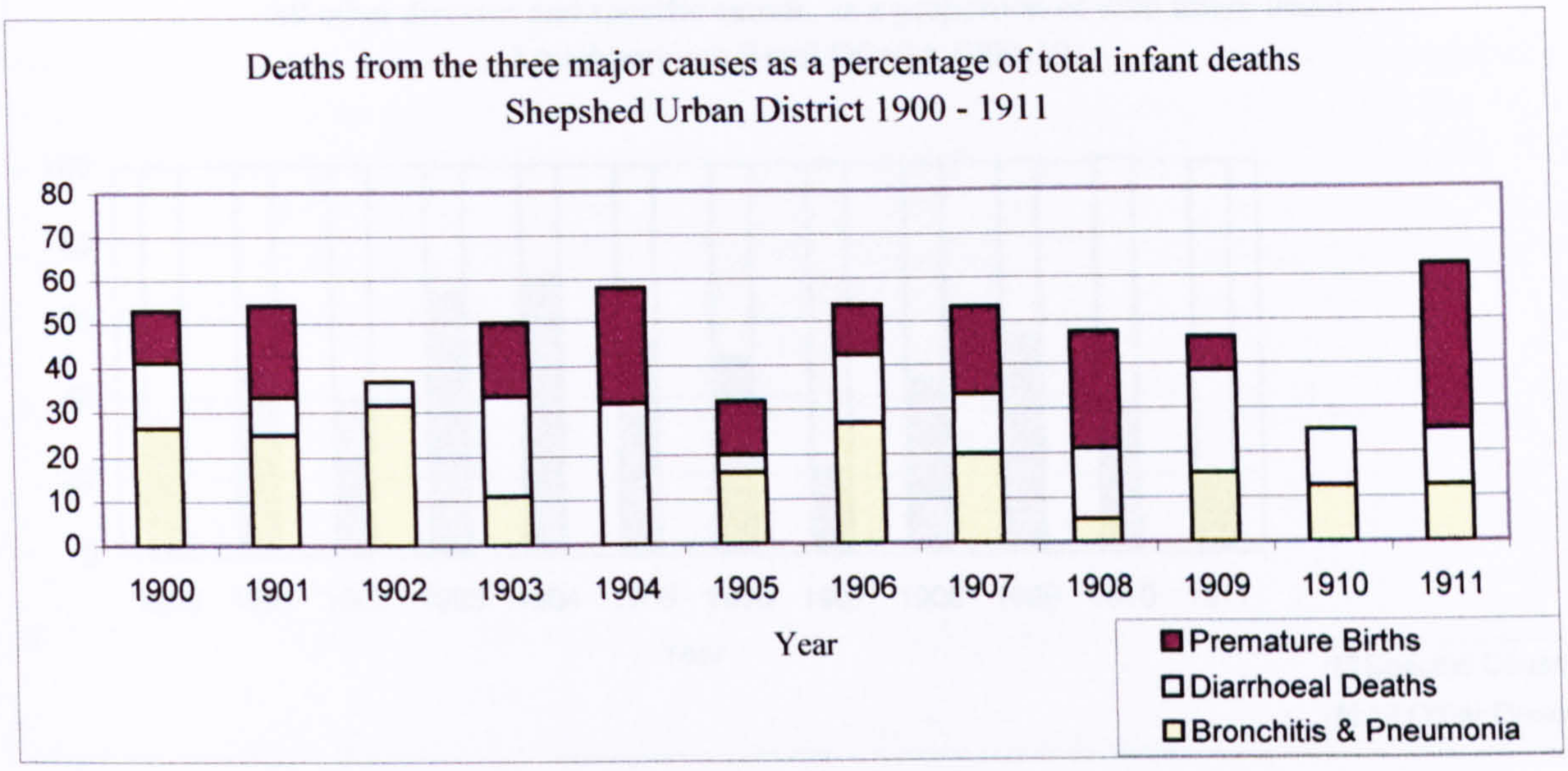
Age and Cause		*Position*
Infant death rate at	0-1 month	25% below
	0-3 months	12% below
	3-6 months	14% above
	6-12 months	37% below
Deaths from premature birth & congenital deformity		28% below
Deaths from measles & whooping cough		45% below
Deaths from diarrhoea		20% below
Deaths from bronchitis & pneumonia		the same
Deaths in first year of life		14% below

Source: Table from *The 42nd Report of the Local Government Board* (1912-13:265).

in the former had begun. By 1910, infant mortality in Loughborough from all causes was below the average for the selected urban areas, except for those resulting from bronchitis and pneumonia, which equalled the average. This raises the question of whether these diseases did not respond so well to whatever caused the post 1906 mortality decline that *may* have affected the other causes of death in this table. One must say *may* because we do not know what the situation was before 1907-10.

Appendix 5 gives the causes and numbers of infant deaths for the Loughborough Urban, Loughborough Rural and Shepshed Urban Districts from 1900 to 1911, as reported by the respective Medical Officers of Health. Changes to classification in 1911 necessitated some simple adjustments to correspond with the earlier system. District Medical Officers of Health were all medical men capable of understanding the diverse medical terminology used before the notification of deaths was standardised. The same County MOH for Leicestershire was in post for the period so it can be assumed that his criteria for classification would be consistent over those years, or, if not, that he would have reported any changes. Figure 5.3 presents charts of early twentieth century MOH data with the three main causes of infant deaths shown as a proportion of the total deaths. The illnesses appear to have had a differential impact in each district. Thus in the Loughborough Urban District diarrhoeal deaths were the major contributor to infant mortality in 7 of the 12 years 1900-11. There too, deaths from diarrhoea fluctuated violently from year to year, notably between 1905 and 1906, with a more than three-fold increase. It is of note that this rise did not occur in either of the two other districts. Premature births were a bigger factor there, especially from 1906 onwards. In fact they accounted for a greater percentage of deaths than did diarrhoea in the Loughborough Rural District at that time. While we find no evidence of diarrhoeal deaths in some





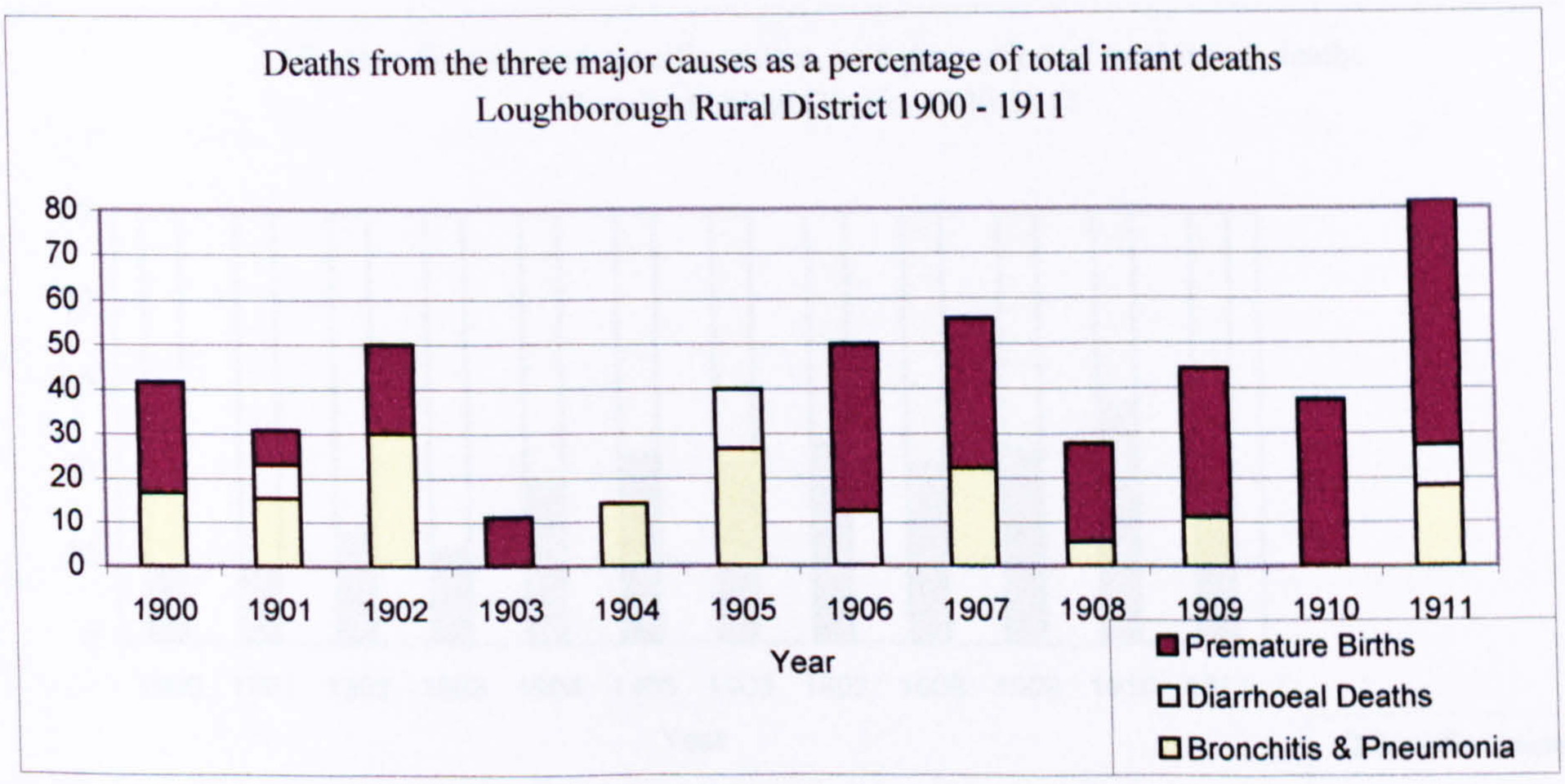
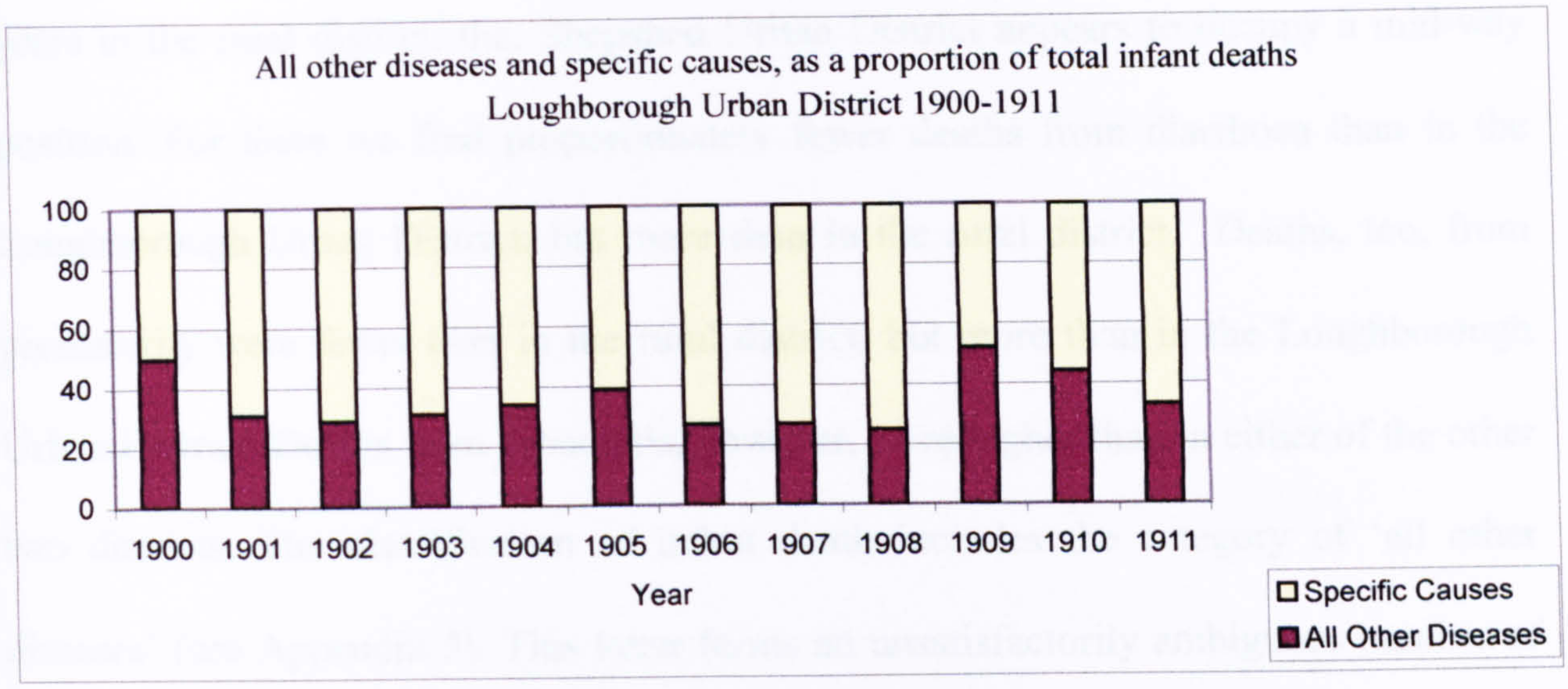
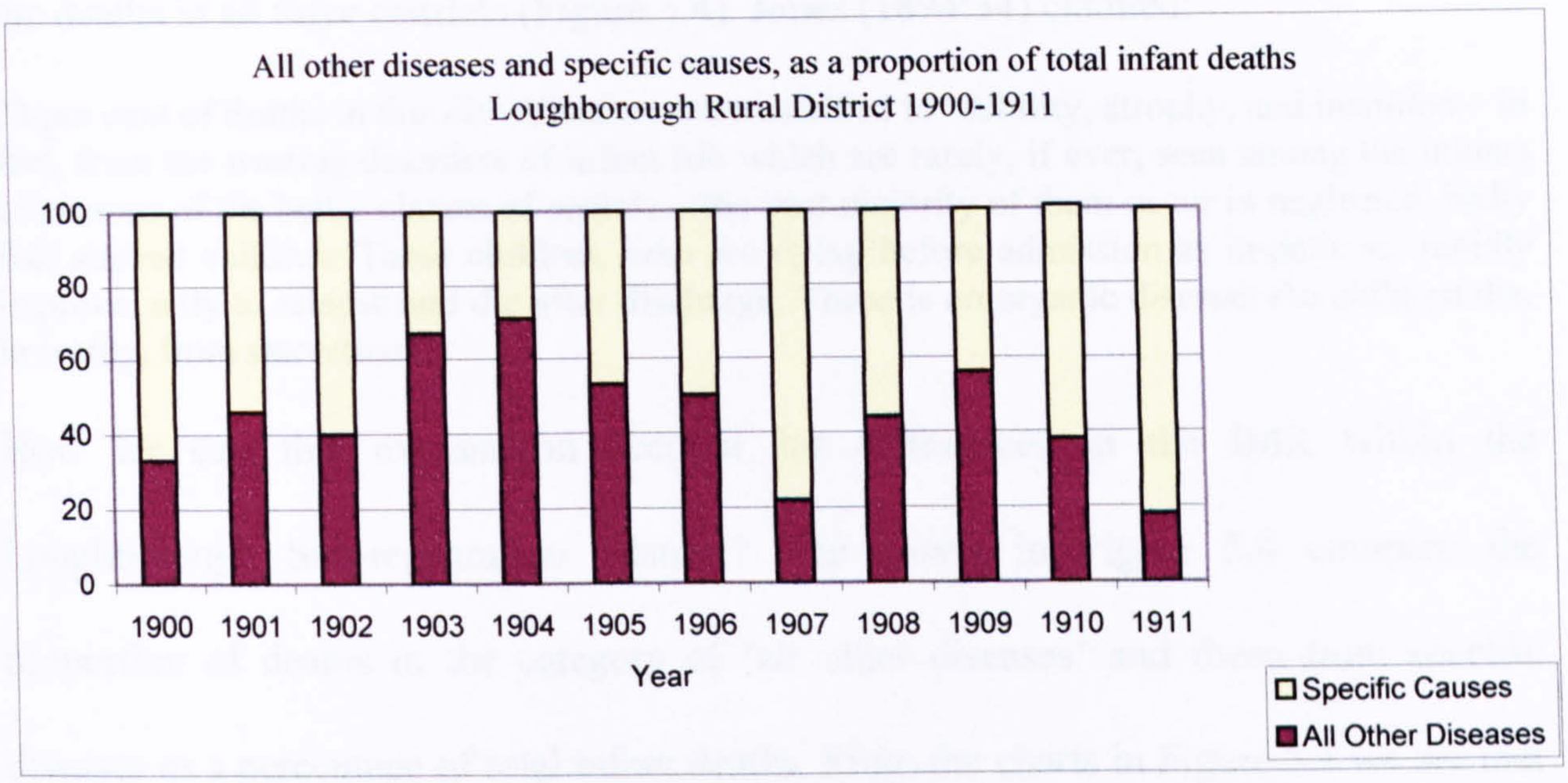


Figure 5.3: Deaths from the three major causes as a percentage of total infant deaths, 1900-1911, in the areas forming the sub-registration district of Loughborough

Source: County MOH Reports for Leicestershire 1900-1911.





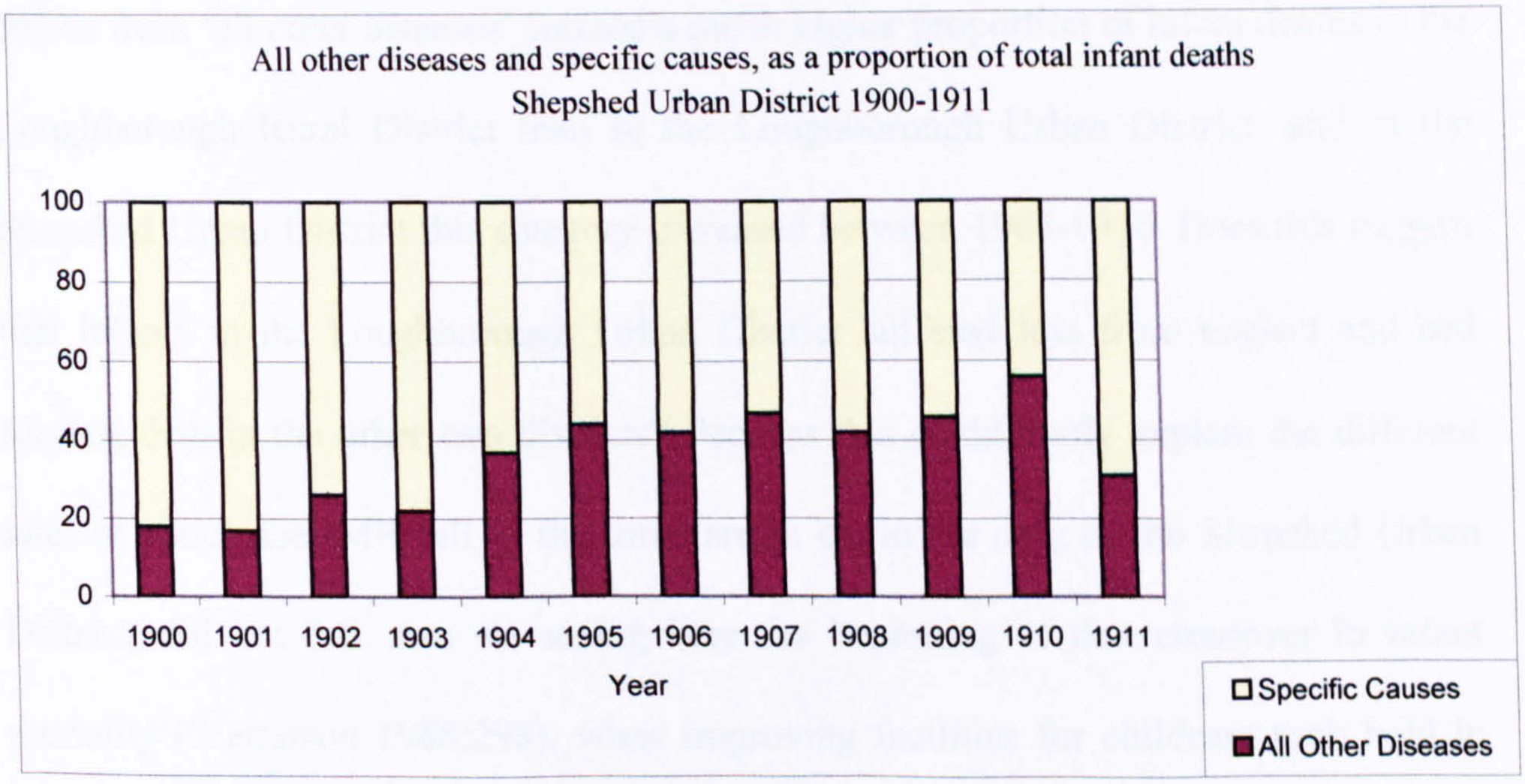


Figure 5.4: All other diseases and specific causes, as a proportion of total infant deaths, 1900-1911, in the areas forming the sub-registration district of Loughborough

Source: County MOH Reports for Leicestershire 1900-1911.

years in the rural district, the. Shepshed Urban District appears to occupy a mid-way position. For there we find proportionately fewer deaths from diarrhoea than in the Loughborough Urban District, but more than in the rural district. Deaths, too, from prematurity were fewer than in the rural district, but more than in the Loughborough Urban District. Deaths from bronchitis, however, were higher than in either of the other two districts. The classification of infant death includes the category of 'all other diseases' (see Appendix 5). This latter forms an unsatisfactorily ambiguous number of the deaths in all three districts (Figure 5.4). Jones (1894:34) claimed:

> 73 per cent of deaths in this classification were ascribed to 'debility, atrophy, and inanition – in fact, from the wasting disorders of infant life which are rarely, if ever, seen among the infants of persons of the better classes of society…the vast majority of them occur in neglected, badly fed, starved children. These children, who are dying before admission as in-patients, rapidly improve, only to relapse and die after discharge. There is no organic disease; the children die, in reality, from starvation.

How far can this explanation account for differences in the IMR within the Loughborough Sub-registration District? The charts in Figure 5.4 compare the proportion of deaths in the category of 'all other diseases' and those from specific diseases as a percentage of total infant deaths. From the charts in Figure 5.4 we see that deaths from 'all other diseases' formed a much higher proportion of infant deaths in the Loughborough Rural District than in the Loughborough Urban District, and in the Shepshed Urban District this category increased between 1905-1910. Does this suggest that infants in the Loughborough Urban District suffered less from neglect and bad feeding than in the other two districts? Perhaps this could partly explain the different rates at which the IMR fell in the three areas: or, in the case of the Shepshed Urban District, did not fall. Are we seeing here the beginning of that crossover in infant mortality (Watterson 1988:298), when improving facilities for childcare took hold in the larger urban areas before the more rural ones? And was the fact that the deaths classed as 'all other diseases' increased between 1904-1910 in the Shepshed Urban

District due to what we might surmise from the worsening economic conditions in the hosiery industry which hit that area particularly hard, and no doubt contributed to the dramatic fall in the rate of population growth there (see above)?

THE TURNING POINT: CHANGE IN CAUSE OF DEATH 1900-06 TO 1907-10

Deaths from prematurity

Table 5.5 *A comparison of deaths from premature births in the Loughborough Sub-registration District before and after the point of rapid secular decline in infant mortality in 1907*

Area	Number of deaths from Premature Birth		Number of Births		Deaths per 1,000 total births		Difference
	1900-06	1907-10	1900-06	1907-10	1900-06	1907-10	
Loughborough Urban District	96	38	4111	2261	23	16	**-7**
Loughborough Rural District	9	19	764	414	11	45	**+34**
Shepshed Urban District	23	9	998	510	23	17	**-6**
Loughborough Sub-registration District	128	66	5873	3185	21	20	**-1**

Note 1: Deaths per 1,000 births are not rounded up, to follow the contemporary County MOH practice in Leicestershire.

Note 2: The MOH Reports do not give the numbers of births for the districts, so these were estimated as a proportion of the Registrar General's total births by calculating an average of the population in each district for the specified years. The percentages of population in each district are listed below:

	1900-1906	*1907-10*
LUD	70%	71%
LRD	13%	13%
SUD	17%	16%

Although there were differences in the birth rates for each district given in the MOH reports, they were insufficient to make it unreasonable to assume a constant birth rate.

Note 3: Figures in red indicate a significant difference was found at a level of five per cent.

Source: Premature deaths from County MOH Reports 1900-1910; births from the Registrar General's *Quarterly Returns* from 1900 – 1910 by Michael Drake (unpublished paper).

Table 5.5 gives, for the urban and rural districts of the Loughborough Sub-registration District, the number of deaths arising from premature birth in the years 1900-06 and 1907-10. Unfortunately these calculations are estimates, because the numbers of births for the three districts forming the sub-registration district are not given in the MOH Reports or in the Registrar General's *Quarterly Returns.* As discussed above, it is not advisable to mix vaccination (cohort) data with period-based data. However, an example was produced taking the numbers of births from the vaccination registers, for illustration only (see Table 5.6 below).

Table 5.6 *A comparison of deaths from premature births in the Loughborough Sub-registration District before and after the point of rapid secular decline in infant mortality in 1907*

Area	Number of deaths from Premature Birth		Total Number of Births		Deaths per 1,000 total births		Difference
	1900-06	1907-10	1900-06	1907-10	1900-06	1907-10	
Loughborough Urban District	96	38	4314	2328	22	16	**-6**
Loughborough Rural District	9	19	494	320	18	59	**+41**
Shepshed Urban District	23	9	1070	526	21	17	**-4**
Loughborough Sub-registration District	128	66	5878	3174	21	20	**-1**

Note 1: Deaths per 1,000 births are calculated using the exact figures from Vaccination Register Data. This table is given as an illustration only, as the author advises caution in using data from mixed sources, as here, using MOH (period) and Vaccination Birth Register (cohort) data.

Note 2: As mentioned above, deaths per 1,000 births are not rounded up, to follow the existing County MOH practice in Leicestershire.

Note 3: Figures in red indicate a significant difference was found at a level of five per cent.

Source: Premature deaths from County MOH Reports 1900-1910; births from the Vaccination Registers.

Aggregated figures for the sub-registration district overall showed no difference using either basis for enumerating births. There was, also, no affect on the overall pattern of

change, with only slight differences between the individual districts. However, both these methods of calculation are flawed, since one relies on estimated births and the other on a mixture of period and cohort data. This problem cannot be overcome without the release of civil register data, which would allow the periodic calculation of births in the two districts, thus avoiding the present estimation. Table 5.5 shows that before the secular decline in the IMR of the Loughborough Sub-registration District, 21 deaths per 1,000 births were the result of premature birth, as against 20 deaths per 1,000 births after the decline began. Thus, this particular cause of death accounted for hardly any of the decline in infant mortality.

Deaths from bronchitis and pneumonia

Table 5.7 *A comparison of infant deaths from bronchitis and pneumonia in the Loughborough Sub-registration District before and after the point of rapid secular decline in infant mortality in 1907*

Area	Number of deaths from Bronchitis & Pneumonia		Total Number of Births		Deaths per 1,000 total births		Difference
	1900-06	1907-10	1900-06	1907-10	1900-06	1907-10	
Loughborough Urban District	82	56	4111	2261	19	24	+5
Loughborough Rural District	12	6	764	414	15	14	-1
Shepshed Urban District	31	10	998	510	31	19	-12
Loughborough Sub-registration District	125	72	5873	3185	21	22	+1

Note 1: As mentioned above, deaths per 1,000 births are not rounded up, to follow the existing County MOH practice in Leicestershire.

Note 2: See Table 4.4 Note 2 for calculation of estimated births.

Source: Deaths from bronchitis and pneumonia from Leicestershire MOH Reports 1900-1910; births from the Registrar General's *Quarterly Returns* 1900 – 1910 by Michael Drake (unpublished paper).

Table 5.7 shows a reduction in deaths from bronchitis and pneumonia in the Shepshed Urban District and the Loughborough Rural District between the two periods around the point of decline in 1907, but almost half of this reduction was counterbalanced by an increase in the Loughborough Urban District. None of these differences was significant at a level of five per cent. Changes in the pattern of deaths from bronchitis and pneumonia, then, were not a major determinant of the rapid secular decline of infant mortality in the area. The absence of a significant change in this category of deaths suggests there was no reduction in the virulence of the bacteria, viruses, fungi or parasites that cause them, nor a major climatic change that would alter the damp atmospheric conditions that aggravate them. Nominative cause of death data is not given in the vaccination registers, so that further investigation is outside the scope of the present work.

Deaths from diarrhoea and enteritis

Table 5.8 compares infant deaths from diarrhoea and enteritis before and after the point of rapid decline in 1907. The total fall in infant mortality in the sub-registration district overall, derived from the Registrar General's *Quarterly Returns,* between the periods 1900- 1906 and 1907-1910, was 40 deaths per 1,000 births. The changes in the urban district of Loughborough and in the sub-registration district overall were significant at a level of five per cent. The changes in the Loughborough Rural District, for which the numbers were extremely small, and the Shepshed Urban District were not significant. Analysis of MOH data, then, shows that this cause of death was an important part of the twentieth century decline, particularly in the Loughborough Urban District, and certainly more important than the other two major causes of infant death.

Table 5.8 *A comparison of infant deaths from diarrhoea and enteritis in the Loughborough Sub-registration District before and after the point of rapid secular decline in infant mortality in 1907*

Area	Number of deaths from Diarrhoea & Enteritis		Total Number Of Births		Deaths per 1,000 total births		Difference
	1900-06	1907-10	1900-06	1907-10	1900-06	1907-10	
Loughborough Urban District	154	45	4111	2261	37	19	**-18**
Loughborough Rural District	4	1	764	414	5	2	**-3**
Shepshed Urban District	23	9	998	510	23	17	**-6**
Loughborough Sub-registration District	181	55	5873	3185	30	17	**-13**

Note 1: As mentioned above, deaths per 1,000 births are not rounded up, to follow the existing County MOH practice in Leicestershire.

Note 2: See Table 4.4 Note 2 for calculation of estimated births.

Note 3: Figures in red indicate a significant difference was found at a level of five per cent

Source: Diarrhoea and enteritis deaths from Leicestershire MOH Reports 1900-1910; births from the Registrar General's *Quarterly Returns* 1900 – 1910 by Michael Drake (unpublished paper).

CONCLUSION

This study of the urban-rural gradient has drawn on vaccination register and MOH data to identify and account for differences in infant mortality between the three areas of the registration sub-district of Loughborough. For the most part, the expected urban-rural mortality gradient did occur between the Loughborough Urban and Loughborough Rural Districts, and infantile diarrhoea was a major contributor to this difference. However, the Shepshed Urban District did not fit the expected pattern. The onset of a sustained twentieth century decline did not begin in Shepshed in the 1900s. Instead, it had the lowest infant mortality of the three districts at the start of the core period of study and the highest at the end. It is difficult to suggest an explanation for this. Rapid

population growth in the 1890s and the resultant strain on the infrastructure in the 1900s may have contributed to the lack of improvement in infant mortality levels in the Shepshed Urban District. The move of the hosiery industry from the home to the factory may also have had a disproportionate impact there; although we know there were factories mapped in the village by 1912, there is no way of knowing how much work these provided, or for whom.

The lack of information on cause of death at the level of the individual has frustrated these attempts to account for the differences in the IMR in the three areas of the sub-registration district. Nor have we been able to get much closer to an explanation by using MOH data. That the prevalence of a particular disease in any one year does not seem to be related directly to the number of infant deaths and that it was incidence rather than deaths that seemed to have been the main concern of the medical officers of health, has been another cause of frustration. Somewhat greater enlightenment has come from the MOH reports for the three areas during the period 1900-11. Deaths from diarrhoea accounted for a greater proportion of deaths in the Loughborough Urban District than in the two other districts, with the smallest proportion in the rural district. Of particular interest is the number of deaths placed in the category of 'all other diseases'. As a proportion of total deaths, these were high in all three areas, the lowest proportion being in the rural district. If we go along with the opinion of a perceptive nineteenth century commentator (Jones 1894:34) that inadequate feeding caused 73 per cent of deaths in this category, then the very high proportion of infant deaths within it may explain why the IMR did not decline in the Shepshed Urban District in the 1900s. For from 1904-11, deaths from 'all other diseases' accounted for a very high proportion of total deaths there.

6

Social class differences in the infant mortality rate

This chapter has two purposes; the first is to investigate the relationships of socio-economic groups[1] (SEGs) with infant mortality in the three districts that form the Loughborough Sub-registration District. The second is to see whether the failure of the Shepshed Urban District to conform to the expected fall in the IMR in the early twentieth century, as evidenced in the two other districts, had a class dimension.

Woods has acknowledged that there is still much to be learned about 'the magnitude of socio-economic inequalities in mortality at a time when infant mortality was declining' (Woods *et.al.* 1993:47). This is, in part, because the data that would make it possible to learn more – the civil birth and death registers – are effectively closed to researchers. Nevertheless some work has been done with the result that for individual years beginning in 1894 we have class based IMRs, the class categorisation being that inaugurated by the Registrar General in 1911. Table 6.1 presents these findings. From this we can draw the following conclusions:

1. From 1905-1949/50, the lower the social class the higher the IMR.

[1] Classification of the father's occupation, taken from the vaccination registers, is based on the system W A Armstrong (1972:215-213) used for York in 1851. When there is doubt, a job requiring no skill goes into Group V; an occupation where one skill is used repetitively goes into Group IV; and employment needing all-round knowledge is defined as Group III, a judgement for which the writer takes responsibility. For example, a boiler or shoe riveter would be SEG IV, but a boiler or shoe maker would be SEG III. This rests somewhat arbitrarily on the job description given in the registers, which may or may not be accurate.

2. From 1905-1949/50, the IMR fell in all classes at approximately the same rate, thus maintaining the relationship between them.

3. From 1894-1901 the IMRs of the individual classes changed comparatively little over time and did not wholly follow the lower the social class, the higher the IMR rule.

Table 6.1 *Infant mortality rates by social class of father, various years, 1894 – 1950, England and Wales*

	1894	1896	1899	1901	1905	1910	1911	1921-3	1930-2	1939	1949-1950
Total IMR where given	-	148	153	-	130	-	123	79	62	47	29
I	106	102	101	90	76	57	76	38	33	27	19
II	124	125	127	130	105	76	106	55	45	34	22
III	127	153	156	128	130	80	113	77	58	44	28
IV	128	148	155	138	136	95	122	89	67	51	34
V	171	171	177	149	153	110	153	97	77	60	40
Agricultural Labourers	97	115	116	95	101	36	96	67	58	47	29
Miners	156	178	183	165	158	123	160	104	81	65	43
Textile workers	159	168	172	117	149	102	148	90	68	53	32
Farmers	97	97		80			74	51	46	40	24

Note: The year 1911 is not representative of long-term trends as infant mortality increased nationally in that year. Highlighted SEGs follow the pattern of increase with descent in social scale.

Source:

1896, 1899, 1905, 1911, 1939, 1949-50	Haines (1995:313 Table 6).
1894, 1901, 1910	Garrett *et al* (2001: Table 4.11.2).
1911, 1921-3, 1930-2	Titmuss (1943:23,26).

How can we explain these differences? One possible explanation would be that in the 1890s environmental factors played a greater part in determining levels of infant mortality than did class factors, whilst in the twentieth century the reverse was the case. Thus although in the 1890s a child born into a higher class would, for the most part, still have a better chance of survival, relatively speaking, than one born in a lower class, environmental factors reduced the survival chances of all. And these

environmental factors – clean water, efficient water-borne sewage disposal, effective scavenging etc. – were slow to be addressed in many areas. By the twentieth century all classes benefited from the diminution in environmental hazards so the IMRs of all classes fell. However now the social class factors, which had been overshadowed in the 1890s, came to the fore, creating the familiar class gradient.

Does the evidence drawn from the Loughborough Sub-registration District support this interpretation or, indeed, add a new dimension to the national picture? It should be remembered that from 1894-1911, the national IMRs given in Table 6.1 are based on evidence collected retrospectively as part of the 1911 census, not on civil registers of births and deaths (Haines 1993; Garrett *et.al.* 2001). The Loughborough data comes more directly from transcripts of those registers. It should then, on the face of it, be more reliable. Table 6.2 presents the Loughborough evidence for several periods from 1888-1910. It will be apparent that a strict comparison cannot be made as there were so few births and deaths in Classes I and II. The figures for SEGS I and II are included

Table 6.2 Infant mortality rates by social class of father, various periods, 1888 – 1910, Loughborough Sub-registration District

Father's Socio-economic Group	1888-99		1900-10		1900-06		1907-10	
	Births	IMRs	Births	IMRs	Births	IMRs	Births	IMRs
I	78	89	58	86	43	93	15	66
II	335	101	317	66	191	78	126	47**s**
III	5626	148, **ii**	4576	**112, ii**	3008	128, **ii**	1568	**82s**
IV	1663	165, **i,ii**	1980	**132, ii,iii**	1253	153, **ii,iii**	727	**96s, ii**
V	2171	186, **i,ii,v**	2129	**161, i,ii, iii, iv,v**	1391	167, **ii,iii**	738	149**s, ii,iii,iv**
Difference I -V	97		75		74		83	

Note: Red figures denote a significant periodic difference at a level of five per cent. The letter 's' denotes a significant periodic difference between 1888-99 and 1907-10. The roman numerals after an IMR denote a significant difference with other SEGs within a particular period. Yellow- highlighted SEGs follow the pattern of increase with descent in social scale.

Source: Vaccination and Infant Death Registers.

here for the reasons given in the introduction to this thesis (see also Appendix 6). And it should be noted that if we look at the period as a whole, it is clear that the IMR of children born into Classes I and II combined, at 80 per 1000 births (there were 1163 births and 93 deaths), was lower than that of any of the other classes. Turning to the experience of the other classes it would seem that:

1. The higher the social class the lower the IMR rule applied throughout the period[2]. This may well have been the case in other parts of the country, but – if the figures in Table 6.1 are to be believed – it was not the case in the country as a whole.

2. The IMRs of all classes were lower in the 1900s than they had been in the 1890s.

---

[2] Due to the nature of the data, analysis of individual occupations was unsatisfactory due to the small numbers involved. However, in the interests of further research an interesting phenomenon is worth noting. Infant mortality according to occupation did not necessarily follow the expected class gradient in infant mortality. The following table demonstrates this for the infants of colliers, classified in SEG V, and coal merchants and dealers classified in SEG III. The numbers of deaths at this level are necessarily small, but nonetheless their variability here is perplexing.

A comparison of IMRs for colliers (SEG V) and coal merchants and dealers (SEG III) in the three districts forming the Loughborough Sub-registration District, 1888-1910

Period	**Loughborough Urban District**		**Shepshed Urban District**		**Loughborough Rural District**	
1888-1910	*Births*	*Deaths*	*Births*	*Deaths*	*Births*	*Deaths*
Colliers/Miners	13	2	61	3	134	14
	-		49		104	
Coal merchants/dealers	35	3	39	7	7	2
	85		179		285	

Source: Vaccination and Infant Death Registers

Although the infants of farm labourers (SEG IV), and farmers and graziers (SEG II), followed the urban-rural dichotomy, they also did not follow the expected class gradient, as is seen in the table below:

The infant mortality experience for agricultural labourers (SEGIV) and farmers and graziers (SEG II), Loughborough Sub-registration District, 1888 – 1910

	Loughborough Urban District		**Shepshed Urban District**		**Loughborough Rural District**	
1888-1910	*Births*	*Deaths*	*Births*	*Deaths*	*Births*	*Deaths*
Farm Labourers	66	8	69	5	164	11
IMR	**121**		**72**		**67**	
Farmers & Graziers	30	6	65	5	129	13
IMR	**218**		**76**		**100**	

Source: Vaccination and Infant Death Registers.

3. Though the IMRs in the years 1900-06 were lower than in the 1890s, the difference was nothing like so great as between the years 1907-10 and the 1890s.

4. Between 1888-99 and 1907-10 the IMR of Class V fell by 20 per cent, that of Class IV by 42 per cent and that of Class III by 45 per cent.

There are then some similarities and some differences between the national IMRs and those for the Loughborough Sub-registration District. The expected class gradient appears earlier in Loughborough than nationally, but the relatively uniform fall in the national IMRs across the five classes, which meant that although all fell the relative positions remained the same, was not evident in Loughborough. There the fall in the IMR of Class V was less than half that of Classes III and IV. We may conclude from this that whatever caused the fall in the IMRs of Classes III and IV had a smaller impact on the infants of Class V. Watterson found this at the national level, remarking that the decline in the infant mortality of Class V came later than for the other socio-economic groups (Watterson 1988: 296) [3]. As we shall see, the cause in the Loughborough Sub-registration District appears to be because the IMR for infants of unskilled labourers, who made up a substantial part of Class V, actually rose in the Loughborough Rural and the Shepshed Urban Districts.

Table 6.3 disaggregates the figures that appear in Table 6.2, apart from those in Classes I and II, which were too small to be meaningful when presented on their own. We now see that within the Loughborough Sub-registration District, the IMRs of its constituent parts varied somewhat. Only the largest area, the Loughborough Urban District, had the expected class gradient in the years 1888-1906 and 1907-10. It is also, perhaps, worth noting that between these two periods the IMR of Class III fell by 45 per cent,

---

[3] Using data from the Registrar General, Woods *et al* (1988:365), investigated mortality decline between 1861 – 1921 in England and Wales and found 'income and social class do have a significant influence on the level of infant mortality, but they do not appear to have been of critical importance in influencing either the timing of decline or the rate of change of infant mortality'.

that of Class IV by 33 per cent and that of Class V by 26 per cent. This is interesting in view of the fact that within both the Shepshed Urban and the Loughborough Rural Districts not only did the IMR of Class V not fall, it actually rose between 1888-1906 and 1907-10. Furthermore the expected class gradient did not appear in these two areas.

Table 6.3 *A comparison of infant mortality rates for the Loughborough Sub-registration District and its formative districts in socio-economic groups III-V, before and after the secular decline of infant mortality from 1907 in the Loughborough Urban District*

	Loughborough Sub-registration District	Loughborough Urban District	Shepshed Urban District	Loughborough Rural District
Group III				
1888-1906	**141**	**139**	153	**130**
1907-1910	**82**	**77**	134	**66**
Group IV				
1888-1906	**160**	**171**	**134**	**135**
1907-1910	**96**	**115**	**64**	**49**
Group V				
1888-1906	**179**	**204**	135	107
1907-1910	**149**	**150**	141	157

Note: Figures in red denote a significant periodic difference at a level of five per cent.

Source: Vaccination and Infant Death Registers.

OCCUPATIONAL DIFFERENCES IN THE INFANT MORTALITY RATE

The vaccination and infant death registers have provided us with the data on which to build a social class analysis of infant mortality. The social classes used here were derived from the occupational data in those registers. We can then also examine infant mortality according to the occupation of the infant's father. The advantage of this is that, on the assumption that socio-economic factors are important in understanding variations in infant mortality, we get closer to those factors than we do with a class analysis, since, by definition, class is a grouping of various occupations which are likely to vary somewhat. Numbers were small in most occupations – one reason for

adopting class as a framework for analysis - to the extent that one must hesitate about placing too much weight on the IMRs based upon them. However the hosiery industry did provide sufficient numbers and we will look at its members here[4]. The absolute numbers of births and deaths in the other occupations appear in Appendix 6 as, when joined with those from other areas, some lessons may be learned (see the Introduction to this thesis).

The IMR amongst the children of hosiery workers[5] – other than framework knitters – fell dramatically between 1888-1899 and 1900-1910. In the former period it was 146 deaths per 1000 births; in the latter only 63. The prospect for the infants of the framework knitters was less bright. In the early 1890s the framework knitters were the largest group of workers in the Loughborough Sub-registration District, with sufficient numbers to provide a statistically significant analysis of infant mortality in both the Loughborough and Shepshed Urban Districts. By the end of the period, however, their numbers had shrunk dramatically. Framework knitters worked in their own homes on a frame that was usually rented and were engaged chiefly in wool and worsted manufacture. Since the main product was hose, or stockings, knitters were often known as 'stockingers', but shirts and gloves were also made. While the husband worked on

---

[4] There was another occupational group with sufficient numbers for analysis. Over the period 1888-1899 and 1900-1910, the mortality rate for infants of engineering workers, including all machine and engine fitters, classified in SEG III, fell by 40 deaths per 1,000 births, from 157 to 117, and this was statistically significant. There were sufficient numbers in this group for a further periodic comparison; from 1900-1906 to 1907-1910, infant mortality fell by 69 deaths per 1,000 births, in line with the overall pattern of decline from 1907 in the district as a whole. The differences between the later period [1907-1910] and each of the earlier ones [1888-1899, 1900-06] were both significant.

[5] Garrett and Reid (1995:78) observed that the manufacturing environment exhibited the worst record for the survival of young children. Occupational health hazards were a feature of some industries, for example the Staffordshire potteries, but the MOH reported no such hazards in the Loughborough manufacturing area. His silence may mean that no problems existed, or that no dangers were perceived at that time. With no known health hazards in the study area, the biggest impact of the father's occupation on family life was probably in the wages he earned. If the mother also worked, the additional income would contribute to the prosperity of the family in different ways, depending on, for example, whether the father was a steady husband receiving a poor wage or a drunken spendthrift on a higher one. Information on the mother's occupation is, however, only given in the vaccination registers when the birth occurred outside marriage.

the frame, the wife seamed the stockings and the children wound the thread, so when this industry failed the whole family had no work. Framework knitting was a skilled occupation and so was allocated to Class III in this study. From the middle of the nineteenth century, when there were 906 frames in Loughborough, the industry was being gathered into small workshops (Royle 1981: 16). The Government had been converted to the benefits of purchasing its supplies from factories at the time of the Boer War, but later returned some orders to framework knitters to avoid the destitution of their families. By 1913 home working had been almost entirely superseded by factory manufacture.

Table 6.4 *Birth, deaths, and infant mortality rates for framework knitters, Loughborough Sub-registration District, 1888 – 1910*

1888 – 1910	**Loughborough Sub-registration District**	**Loughborough Urban District**	**Shepshed Urban District**	**Loughborough Rural District**
Births	2164	983	922	259
Deaths	319	149	145	25
IMRs	**147**	**151**	**157**	**96**

Note: The figure in red denotes a significant difference at a level of five per cent between the IMR for the Loughborough Rural District and all the other groups

Source: Vaccination and Infant Death Registers.

Table 6.4 presents the number of births, infant deaths and the IMRs of infants born to framework knitters in the Loughborough Sub-registration District and its constituent districts for the period 1888-1910. Although the numbers of births to this group are similar in both the urban districts, it should be noted that the population of the Shepshed Urban District was only about one quarter that of the Loughborough Urban District, so framework knitters formed a much larger proportion of the workforce there. The difference in infant mortality for this occupation in the Loughborough Rural District was significant at a level of five per cent as against the other two districts and

the area overall[6].

In Table 6.5, the IMRs amongst the infants of framework knitters are compared over time and between the constituent districts of the Loughborough Sub-Registration District. It would appear that their IMR fell by around 30 per cent in the Loughborough Urban District but actually *rose* in the two others. The decline of an industry can be sudden or long-drawn out. In the case of the framework knitters it appears to have been a bit of both: slow decline from the mid-nineteenth century, rapid decline over the 1890s and 1900s. This latter decline hit the Shepshed Urban District particularly hard, as framework-knitting had been so much more important there than in the Loughborough Urban District. Decline, in industries such as framework knitting, takes the form of falling incomes – one recalls the decline of the handloom workers in

Table 6.5 *A periodic comparison of infant mortality rates for infants born to framework knitters Loughborough Sub-registration District, 1888 – 1899 and 1900 – 1910*

Framework Knitters	***Period***	
Area	**1888-99**	**1900-10**
Loughborough Sub-Registration District	152	132
Loughborough Urban District	***165***	***113***
Shepshed Urban District	156	159
Loughborough Rural District	94	105

Note: Figures in red denote a significant difference at a level of five per cent occurred in periodic IMRS at the turn of the century

Source: Vaccination and Infant Death Registers.

[6] While the overall IMRs for framework knitters in the urban districts of Loughborough and Shepshed for the period 1888 – 1910 are very close, a great deal of fluctuation occurs in the annual rates. The differences were found to be statistically significant for the infants of framework knitters between the two urban districts in four years: 1888, 1889, 1900 and 1904. The significant differences in 1888 and 1889 reflected significant differences between all births in the two urban districts in those years, but this was not the case in the years 1900 and 1904. MOH records showed the causes of death were similar in the two urban districts. A phenomenon of the year 1900 was that all infants born to framework knitters in the Loughborough Urban District survived their first year. In 1904, the mortality rate for infants of framework knitters in the urban districts of Loughborough and Shepshed was higher than any of the annual rates for the whole of SEG III from 1888 – 1910. However, a reduction in the number of deaths from premature birth in the Loughborough Urban District, which did not occur in the Shepshed Urban District, may have contributed to the difference between the two urban districts in this particular year. No single reason was found to explain the significant differences between the two urban districts in these four years.

the Lancashire cotton industry. Lower incomes would reduce living standards and would, other things being equal, impact adversely on the infant mortality rate. Here then is one explanation of the different trajectories of the IMR in the Loughborough and Shepshed Urban Districts in the course of the 1890s and the 1900s[7].

We now turn our attention to another sizeable group of workers: the labourers. During the core period of study, over 2,000 births occurred to the largest occupational group of all, the unskilled labourers. This group experienced a high IMR at 180 deaths per 1,000 births in the sub-registration district overall. Table 6.6 gives the IMRs for unskilled labourers for each area of the sub-registration district at various periods from 1888-1910. The level of infant mortality over this period was in line with the urban-rural gradient except during the period 1907-1910 when the rate in the Shepshed Urban District was not only much higher than in the other two districts, but actually higher than it had ever been in the years 1888-1910. When we look more closely at changes over time, we find that the IMR for labourers in the Loughborough Urban District fell from 1888-99 to 1900-1910 and within the latter period from 1900-06 to 1907-10. In

7 *A comparison of infant mortality rates for infants born to frame-work knitters and socio-economic group III, Loughborough Sub-registration District, 1888 – 1899 and 1900 – 1910*

Area	1888 – 1899		1900-1910	
	FWK	*SEG III*	*FWK*	*SEG III*
Loughborough Sub-Registration District	152	**148**	132	**112**
Loughborough Urban District	***165***	**149**	***113***	**106**
Shepshed Urban District	156	147	159	158
Loughborough Rural District	94	134	105	101

Note: Figures in red denote a significant difference at a level of five per cent occurred in periodic IMRS at the turn of the century

Source: Vaccination and Infant Death Registers

This analysis shows that a large occupational group did not necessarily follow the pattern of its socio-economic group as a whole. In the periodic data for the sub-registration district overall, the periodic difference for SEG III was significant, but this was not the case for framework knitters. In the Loughborough Urban District, however, the periodic change in both the occupation and the SEG were significant. The annual IMRs for infants born to framework knitters and to SEG III overall in the urban areas were not found to be significantly different, except for the year 1900 in the Loughborough Urban District when, unusually, all infants to framework knitters survived.

the Shepshed Urban District, however, the IMR rose between each of these periods.

Table 6.6 *Infant mortality rates (IMRs) for labourers in each area of the Loughborough Sub-registration District for various periods, 1888 – 1910, the number of births in each area, together with a comparison of IMRs including and excluding the births and deaths of labourers' infants for the sub-registration district and for SEG V*

IMRs (Deaths per 1,000 births)	**Loughborough Urban District**	**Shepshed Urban District**	**Loughborough Rural District**
Periodic IMRs for the infants of labourers			
Years: 1888 – 1899	217	141	101
Years: 1900 – 1910	176	172	92
Years 1900 – 1906	192	168	85
Years 1907 – 1910	145	185	105
Comparison of IMRs including and excluding labourers infants, 1888-1910			
Districts	**146s**	136	**118**
Labourers	***197s***	***155***	***97***
All except labourers	136s	132	124
Comparison of IMRs for SEG V without labourers infants for the years, 1888-1910			
SEG V	**196**	**136**	**116**
SEG V less labourers	**191**	**115**	153
Births for the years, 1888-1910			
Infants of labourers	2374	481	349

Note: Figures in red denote a significant difference occurred horizontally at a level of five per cent from the Loughborough Urban District. Italicised figures were also significantly different from each other. The letter 's' denotes a significant difference occurred vertically between the sub-registration district and the occupational groups.

Source: Vaccination and Infant Death Registers.

The proportion of unskilled workers in SEG V varied; it formed 82 per cent of that class in the Loughborough Urban District, but only 53 per cent in the Shepshed Urban District and 66 per cent in the Loughborough Rural District. The influence of this large occupational group can be seen on both the urban-rural gradient of infant mortality and on the overall IMR for Class V, when it is removed. It is not known why the IMR for

the Loughborough Rural District rose in SEG V[8] when the births and deaths for infants of unskilled workers were removed from the group.

Our evidence, then, sends out mixed messages. In the Loughborough Urban District the infants of both framework knitters and unskilled labourers experienced lower rates of mortality in the late 1900s, in line with the population as a whole. They did not do so

[8] Garrett *et al*'s (2001) figures, calculated from the OPCS data set drawn from the 1911 census, indicated the IMR amongst miners was worse than that of SEG V in the twentieth century, whereas Woods *et al's* (1993) data, using Watterson's class-specific estimates from the 1911 Census, suggested the difference was not great in either century (see below).

Estimated deaths per 1,000 births, by father's social class, England and Wales, 1895 – 1910

Father's socio-economic group		1895-97	1895-97	1901-03	1907	1910
I	Professional	121	95	67	59	
II	Intermediate (1-111)	138	129	103	92	
III	Skilled workers	147	138	111	97	
IV	Intermediate (111-V)	149	140	117	105	
V	Unskilled workers	166	165	143	127	
VI	Textile workers	164	155	135	123	
VII	Miners	169	164	148	132	
VIII	Agricultural labourers	110	105	91	87	

Source: Woods *et al* (1993:46 Table 1).

Miners' infants in the Loughborough Sub-registration District, during the period 1888-1910, experienced an overall IMR of 91 deaths per 1,000 births, one of the lowest rates for occupations that produced a sufficient number of births for analysis. SEG V experienced a rate of 175 during the same period. The majority of births (134) to colliers occurred in the rural district, with approximately half this number (61) occurring in the Shepshed Urban District and very few (13 births and 2 deaths) taking place in the Loughborough Urban District during this period. However, the IMR was 104 deaths per 1,000 births in the rural district and only 49 deaths per 1,000 births in the Shepshed Urban District. Woods (2000:243), in discussing the social class gradient of male mortality in the nineteenth century, observed:

> [t]he balance of evidence...would suggest that the contribution made by the accompanying environmental, economic and selective factors[8] to the life chances of adult males was substantially greater than the actual work done'.

Infant mortality among miners' children was higher, relatively speaking, than the mortality of the miners themselves (Woods 2000:237). Woods' (2000:239) comments on the variations in life expectancy for miners between and within the various mining areas could very easily be said of infant mortality overall:

> at the extremes, the type of work in which an adult was engaged could injure his or her health through crowding together in an unsanitary environment, through contact with poisonous substances, through exposure to situations with a high accident risk, or through contact with the already ill. However...within a large occupational group there might be significant differences in experience and...the wider environment certainly did have an important bearing.

in the Shepshed Urban District. This might suggest that some general factor operated in both areas: in the one it had a beneficial impact, in the other an adverse one[9]. This could be an economic one: Loughborough with a varied and expanding set of industries; Shepshed with a once dominant one now in rapid decline. One thing is certain, the increased IMRs for labourers must have contributed to the lack of decline in the Shepshed Urban District from 1907.

One aspect of this social class analysis of infant mortality rates remains to be considered; that is the shift in the numbers of births and infant deaths from one class to another over time. We will confine our attention to the two urban districts and SEGs III IV and V where the numbers are greater and the statistics more robust. We can measure the impact of the decline in framework-knitting indirectly by looking at the changing number of births in the different classes in the different parts of the Loughborough Sub-registration District (Table 6.7). As mentioned above, this group of skilled workers was placed in SEG III. A glance at Table 6.7 will reveal that the number of births ascribed to this class in the Shepshed Urban District fell from 1053 in the years 1888-99 to 567 in the years 1900-10, a fall of 46 per cent. There was a fall too in the Loughborough Urban District (from 4231 to 3762) but at 11 per cent it was

---

[9] Garrett *et al* (2001:143) observed that, for *child* mortality, in favourable environments, such as agricultural areas, there was little difference between the experiences of different classes whereas in manufacturing environments, which were not conducive to child health, a consistent and significant social class gradient in child survival is evident. If we then make two not unreasonable assumptions, that a social class gradient is indicative of an unhealthy environment, and that this would also be demonstrated by *infant* mortality, then the presence of a social class gradient in the IMRs for England and Wales for the period 1894 to 1950, as seen in Table 6.1, suggests that unhealthy environments prevailed throughout that time. From the fact that the social class gradient is not upheld in the Loughborough Sub-registration District after the turn of the century, it could be argued that a change in the environment took place there. If, as Garrett and Reid said, it was the lower social classes who lived in the most unhealthy areas, any improvement occurring in these areas would be seen by a rapid decline of infant mortality in the lower SEGs. This did, in fact, occur at the turn of the century in the Loughborough Sub-registration District, as shown in table 6.2, when the decline in infant mortality was significant at a level of five per cent for SEGs III, IV and V. In the country overall there was a reduction in infant mortality in every SEG except SEG II at the turn of the century. It seems, then, that the determinant of infant mortality at the start of the national rapid secular decline benefited the whole population and was neither specific to 'who one was' nor 'where one lived'. This supports Woods *et al*'s (1988:365) claim that social class was not a major influence on the timing of decline.

Table 6.7 *A comparison of births and deaths in the districts forming the Loughborough Sub-registration District, 1888-1899 and 1900-1910*

	Loughborough Urban District		Shepshed Urban District		Loughborough Rural District	
	Births	**Deaths**	**Births**	**Deaths**	**Births**	**Deaths**
1888 - 1899						
SEG I	64	6	5	1	9	0
SEG II	203	21	59	4	73	9
SEG III	4231	633	1053	155	342	46
SEG IV	1220	212	275	38	168	25
SEG V	1507	319	390	53	274	33
Total	7225	1191	1782	251	866	113
1900 - 1910						
SEG I	41	4	9	0	8	1
SEG II	177	12	68	4	72	5
SEG III	3762	401	567	90	247	25
SEG IV	1297	192	436	48	245	22
SEG V	1364	244	516	71	251	28
Total	6641	853	1596	213	823	81
Difference						
SEG I	-23		4		-1	
SEG II	-26		9		-1	
SEG III	-469		-486		-95	
SEG IV	77		161		77	
SEG V	-143		126		-23	

N.B. A minus figure indicates a decrease.

Source: Vaccination and Infant Death Registers.

very much smaller. We cannot tell what part of either of these falls was due to out-migration, declining fertility or a shift into other classes.

Again turning to Table 6.7 we find that between 1888-99 and 1900-10, the number of births ascribed to classes IV and V rose in the Shepshed Urban District from 665 to 952, or by 43 per cent: in other words, in percentage terms, by very much the same as SEG III fell. On the other hand; in the Loughborough Urban District, the number of births ascribed to SEGs IV and V actually fell slightly from 2727 to 2661, or by just 2 per cent.

The *leit motiv* of this thesis, as noted in the introduction, is that to understand the levels and changes in infant mortality in the late nineteenth and early twentieth centuries, it is necessary to work at the local level. This may be small scale, but it is not parochial, as Wrigley has pointed out (Wrigley 1997). The reason for this is that national aggregates are averages of local experiences and, as such, cannot sustain explanatory arguments, unless a phenomenon, such as the rash of diarrhoea epidemics in the 1890s, is so widespread as to make the local experience a national one. Here I have tried to explain changes in the infant mortality rate within one sub-registration district. The picture revealed by the infant mortality rates for the whole sub-district is seen to be very different to that of its component districts. This, I suggest, might well be the case nationally: the Loughborough Sub-registration District here being the country in microcosm. By using the vaccination and infant death registers I have been able to delve deep into shifts – in this chapter in terms of socio-economic class – within the district. We have seen that the IMR did not follow the same trajectory even within the relatively small area of a sub-registration district. The explanation for this would appear to be a sharp decline in the basic industry of one urban district with a resultant increase in the number of fathers in the lower social classes. As the lower the class the higher the IMR (Table 6.2) this naturally resulted in a higher IMR there. Vaccination register data supports the findings of Woods *et al* (1988:365) that income and social class do have a significant influence on the level of infant mortality, but were not of critical importance in influencing either the timing of the decline or the rate of change of infant mortality, because no single occupation was capable of producing the dramatic decline of infant mortality from 1907 in the Loughborough Sub-registration District, although several occupations appear to have contributed to that decline.

7

Further explorations of infant mortality

So far, two of the major issues in the study of infant mortality during the late nineteenth and early twentieth centuries have been explored using, as the main quantitative sources, the vaccination and infant death registers. It has been argued that these sources, by providing individual level data, allow us to go beyond what is possible with the mainly aggregative data provided by the Registrar General or, at the local level, the Medical Officer of Health Reports. In this final chapter I continue to exploit the potential of the vaccination and infant death registers by conducting a number of exercises into other aspects of infant mortality. These are: the mortality of infants born outside marriage; the infant mortality of twins; the seasonality of infant mortality; the relationship between infant mortality and rateable values, used in this context as a surrogate for income; infant mortality and the geology of settlement sites; the gender distribution of infant deaths; and the age distribution of infant deaths.

THE MORTALITY OF INFANTS BORN OUTSIDE MARRIAGE

There are a number of reasons why there was much contemporary interest in the fate of children born outside marriage: the general moral issue; the fear that such children and their mothers would be a financial burden on the community; and the sheer scale of the mortality they endured. It is this last issue that will be examined here. According to Killick Millard (MOH 1911:20), the MOH for Leicester, the mortality of infants born

outside marriage in the town in 1893 was 495 per 1000. Such a figure is far above anything we have come across in Loughborough: indeed it is a rate that ranks amongst the highest ever recorded in the western world. Millard went on to remark that

> [t]he contrast, which always exists between the mortality of legitimate and illegitimate infants, is a striking proof of the preventableness of infant mortality.

As the Registrar General noted (1911: xxxix), the excess in mortality of illegitimate children varied greatly for different causes of death; the excess was very slight in the case of deaths from congenital defects, and comparatively so for bronchitis and pneumonia, but heavy for diarrhoea and especially so for atrophy, suggesting, he said, a disadvantage in the purity of food and lack of care. Jones (1894: 62) took a broader view, suggesting that the difference in the rates of legitimate and illegitimate infants was because:

> [m]any of the mothers are very young; not infrequently attempts at abortion have been made during early pregnancy; during pregnancy much mental worry and anxiety have been experienced by the mothers. The mothers received but little attention at their confinements. All these factors tend inevitably to excessive mortality.

There is some evidence that the murder of babies in the course of childbirth, especially of those born outside marriage, was sufficiently common to warrant a change in the law (Mooney 1994a: 43). Jones (1894: 62), commenting obliquely on the same theme, remarked that he had it:

> on good authority, that in the practice of certain midwives the number of still births is very high, and that this fact is well known among their *clientéle'* (sic italics).

The law was tightened and this led to a reduction of that particular problem in the course of the late nineteenth century (Langer 1974: 361-2) so that 'the attention of the press turned from infanticide to abortion' (Mooney 1994b: 51 footnote 6). Neither issue is mentioned in any of the MOH reports for the three districts covered by this study. The infant death registers do, however, record some instances of newly born infants of unknown parentage being found dead in the canal and the River Soar.

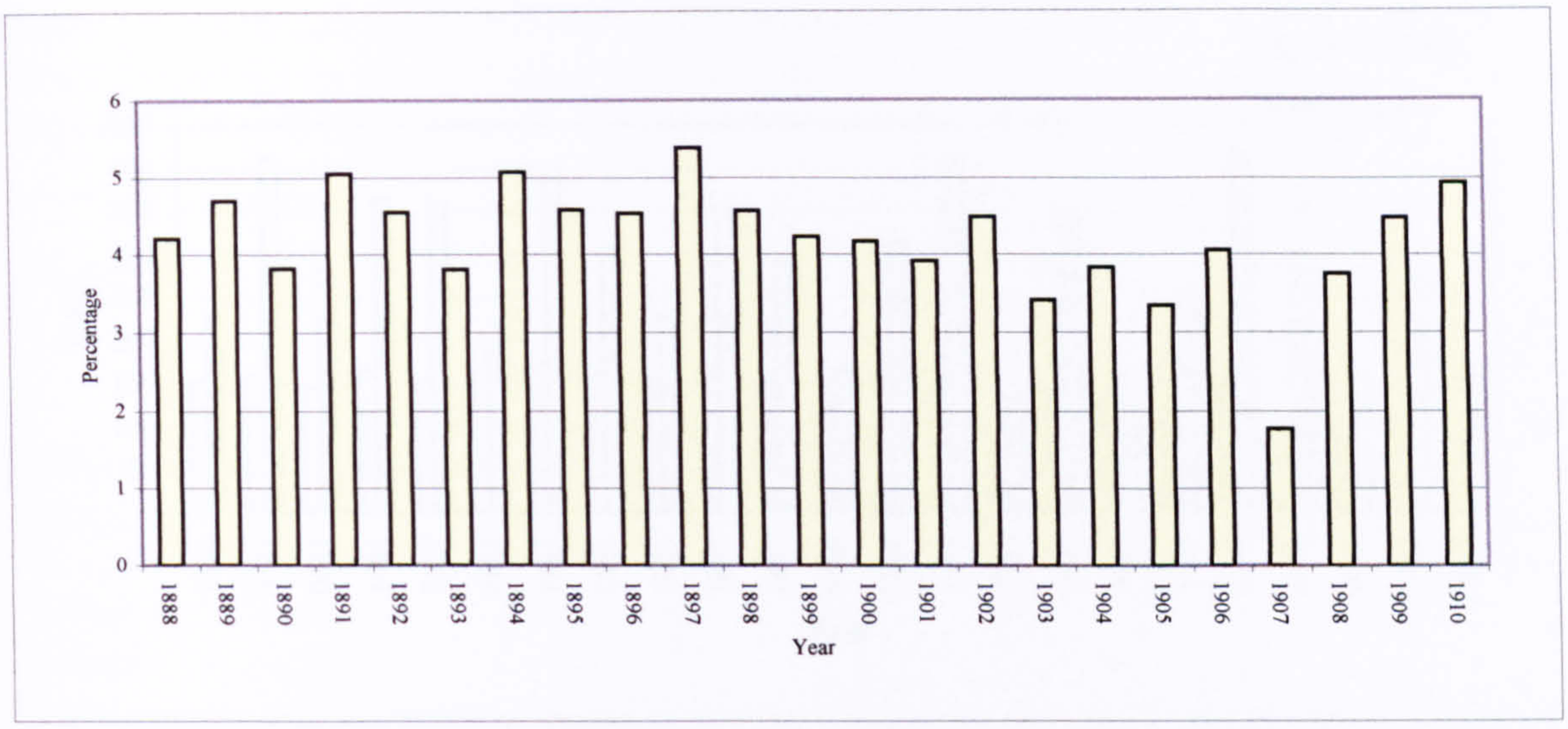


Figure 7.1 Births outside marriage as a percentage of total births, Loughborough Sub-registration District, 1888 – 1910

Source: Vaccination and Infant Death Registers.

Births outside marriage in the Loughborough Sub-registration District accounted for from 4.5 per cent of total births in the years 1888-1899 to 3.8 per cent in the years 1900-1910. This was close to the national figure of around four per cent (Thompson 1992: 278). There were annual fluctuations in the Loughborough figures but, given the small numbers involved, these were remarkably slight. The only exception was the figure for 1907 when the proportion of illegitimate births was unusually low. It may be that the introduction of the Births Notification Act of that year – which reduced the time allowed for the registration of births to 36 hours – brought forward the registration of more births within marriage than outside it (Figure 7.1).

Figure 7.2 below shows that, as expected, the IMR for children born outside marriage was, in most years, very much higher than that for legitimate children, the only exceptions being the years 1893, 1899, 1902 and 1904. The IMR for legitimate births fell from 150 to 121 between 1888-99 and 1900-10, whereas that for illegitimate births fell from 303 to 267, proportionately a much lower reduction. The same was true of the fall in mortality between 1900-06 and 1907-10. As might be expected, then, the

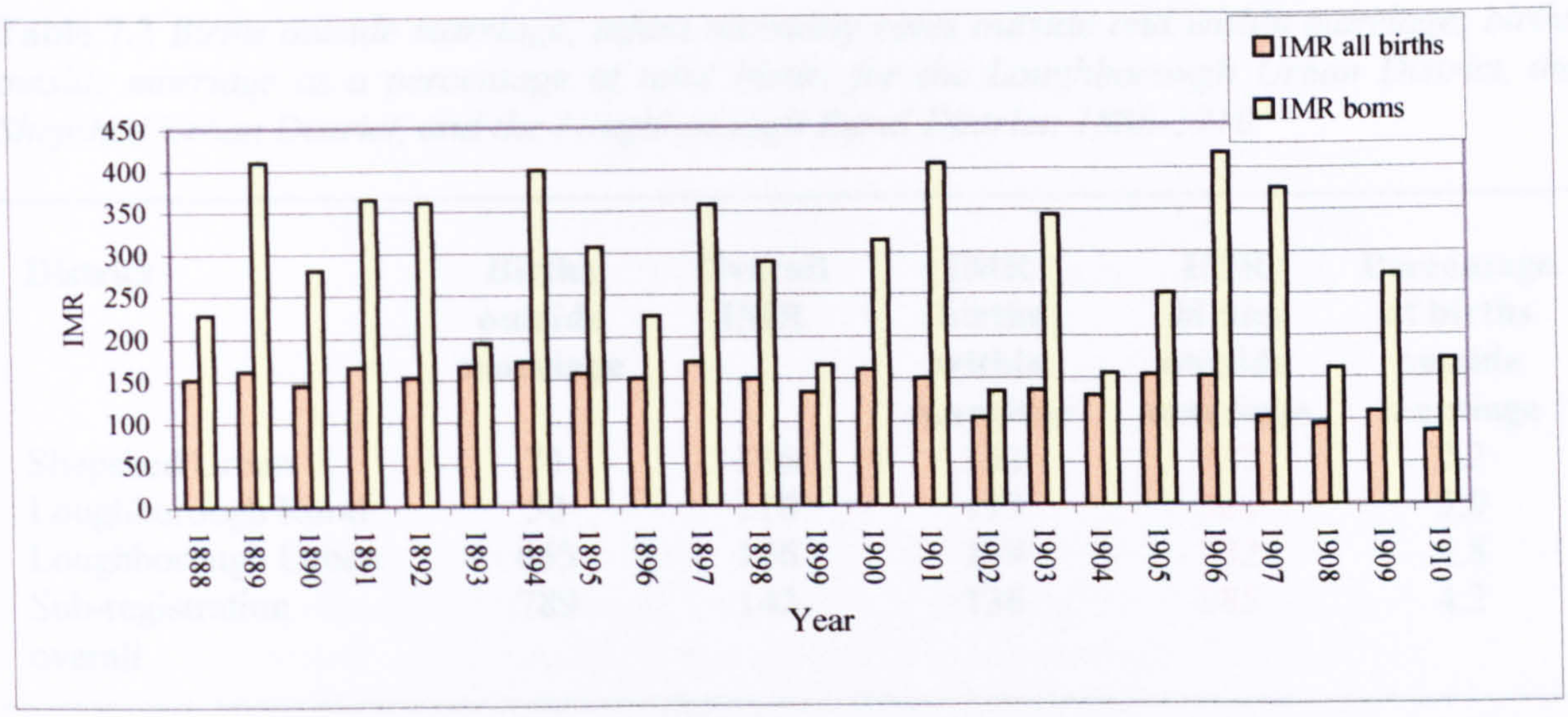


Figure 7.2 Infant mortality rates for total births and for births outside marriage (boms), Loughborough Sub-registration District, 1888 – 1910

Source: Vaccination and Infant Death Registers.

periodic change for births within marriage between both the periods before and after the turn of the century and between the periods 1900-06 and 1907-10 was significant, but no significant periodic difference occurred for births outside marriage (Table 7.1).

Table 7.1 *Births, deaths and infant mortality rates within marriage; births, deaths and infant mortality rates outside marriage (BOM) and BOM as a percentage of total births in the Loughborough Sub-registration District, 1888 – 1910, with periodic comparison of aggregate data*

Year	Births within marriage	Deaths within marriage	IMR	Births outside marriage	Deaths of BOM	IMR for BOM	BOM as % of total births
1888-1910	18,122	2,466	136	792	228	287	4.2
1888-1899	9,414	1,412	150	448	136	303	4.5
1900-1910	8,708	1,054	**121**	344	92	267	3.8
1900-1906	5,649	764	135	228	66	289	3.9
1907-1910	3,059	290	**94**	115	26	226	3.6

Note: Figures in red denote a significant periodic difference occurred at a level of five per cent.

Source: Vaccination and Infant Death Registers.

Table 7.2 *Births outside marriage, infant mortality rates outside and within marriage; births outside marriage as a percentage of total births for the Loughborough Urban District, the Shepshed Urban District, and the Loughborough Rural District, 1888-1910*

District	Births outside marriage	Overall IMR	IMR births within marriage	IMR births outside marriage	Percentage of births outside marriage
Shepshed Urban	74	136	132	297	2.2
Loughborough Rural	50	118	113	300	3.0
Loughborough Urban	665	146	139	282	4.8
Sub-registration overall	789	142	136	285	4.2

Note: Figures in red denote a significant difference occurred at a level of five per cent between the IMRs for births outside marriage and the IMRs for births within marriage and total IMRs for the individual areas.

Source: Vaccination and Infant Death Registers.

When the two sets of IMRs for the constituent parts of the Loughborough Sub-registration District were examined, the differences in all cases were found to be significant at the five per cent level for births outside marriage against both births within marriage and total births. No significant difference occurred for births *outside* marriage between the districts[1] (Table 7.2).

Analysis at this level necessarily deals with small figures, but that should not prevent us from investigating the full extent of the interesting features of this group. Almost 90 per cent of all births outside marriage in the Loughborough Sub-registration District were to women from socio-economic groups IV and V. Table 7.3 (below) compares the infant mortality rates of the children of these women with those born within marriage for the periods 1888-1906 and 1907-10. As expected both fell and at approximately the same rate, perhaps suggesting a common cause or set of causes.

[1] For information, a significant difference at a level of five per cent was found between the Loughborough Rural District against its urban counterpart and the district overall for both births *within* marriage and total births.

Table 7.3 *Infant mortality rates, births within marriage (BWMs) and births outside marriage (BOMs) in SEGs IV and V, Loughborough Sub- registration District, 1888 – 1910*

Period	IMR for births within marriage, SEGs IV & V	IMR for births outside marriage, SEGs IV & V
1888-1906	*157*	307
1907-1910	*116*	237
1888-1910	149	297

Note: Figures in red indicate a significant difference was found at a level of five per cent between births within and outside marriage. Italicised figures indicate the periodic change was also significant.

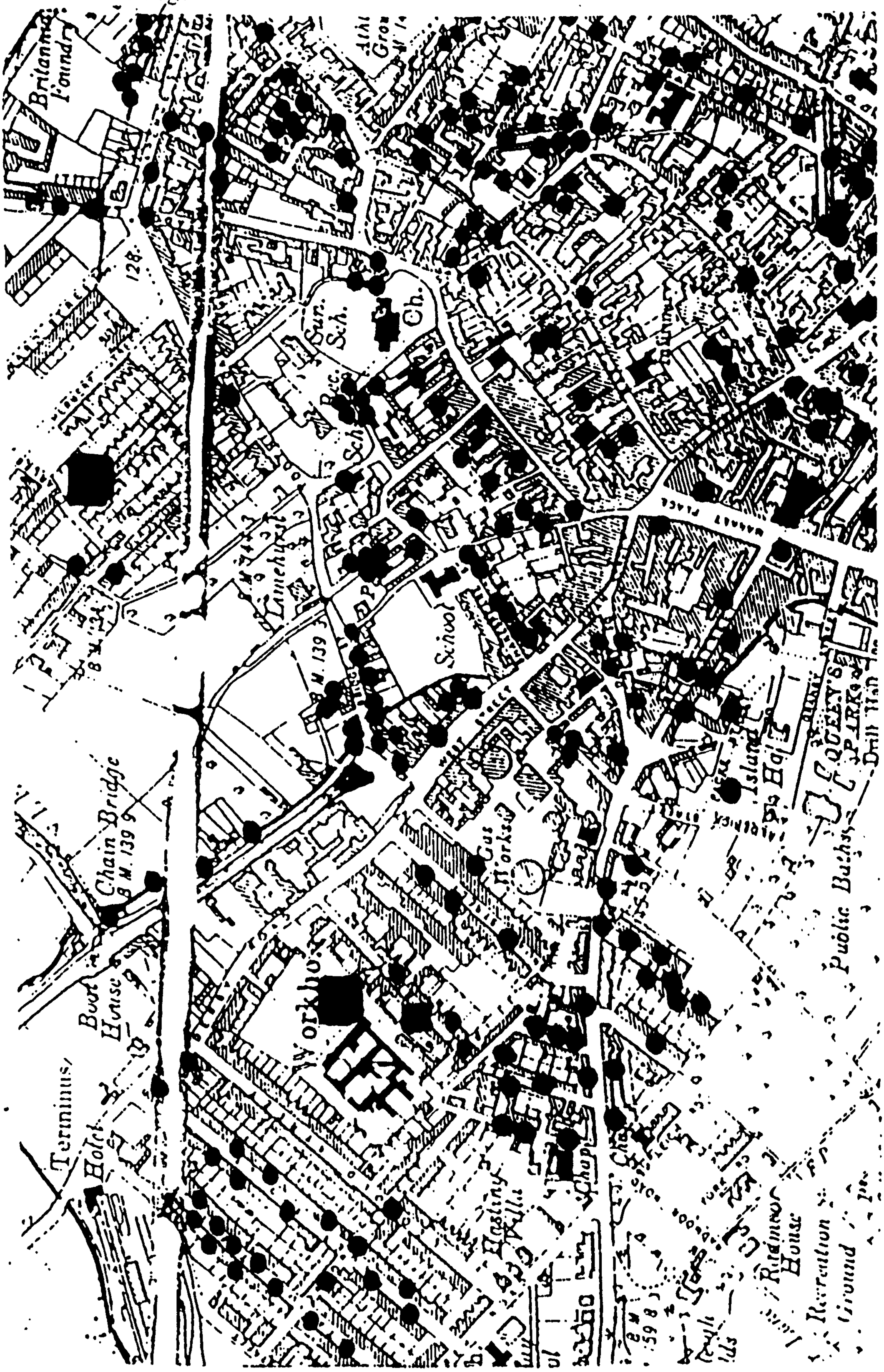
Source: Vaccination and Infant Death Registers.

A map-pinning exercise for the Loughborough Urban District from 1888 to 1910 showed births outside marriage were, for the most part, spread throughout the town, except for a few streets close to the Convent where there were none. They occurred, then, in the same streets as births within marriage and in similar housing. There were, however, clusters of births at three addresses, two related to the workhouse and another at an address in Cambridge Street. Together these accounted for 13.7 per cent of all births outside marriage during the period. Figure 7.3 represents a section of this exercise, with the square blocks denoting the clusters mentioned above. Not every birth had a house number recorded in the vaccination registers, and the site of specific house numbers, where given, can only be approximated.

Between 1888 and 1910, there were 104 births and 24 infant deaths recorded at the Loughborough workhouse[2] and at 59A Regent Street Loughborough, producing an infant mortality rate of 230 deaths per 1,000 births. Of the 104 births 24 were within

[2] For a discussion of the problem of skew caused by institutional mortality, see Mooney, Luckin and Tanner (1999: 227-269).

Figure 7.3: A section of Loughborough demonstrating a map-pinning exercise of births outside marriage



Source: adapted from Pick's (1914:2) Map *River Soar Floods*

marriage, three of them being of workhouse employees. The remaining 80 births outside marriage form slightly more than 10 per cent of all such births in the sub-registration district, with an IMR of 262. The overall IMR for all births outside marriage in the Loughborough Urban District from 1888 to 1910 was 283 deaths per 1,000 births. The children born outside marriage in the workhouse seem to have been faced with slightly less risk than those born outside marriage elsewhere. But what of children born within marriage and in the workhouse? We can go some way to answering this question from evidence collected and analysed by other members of the Open University Project on infant mortality (Table 7.4).

Table 7.4 *Births, deaths and infant mortality rates for total births and for births outside marriage occurring in workhouses in Hollingbourne, Heigham, Lyncombe and Widcombe and Loughborough – various dates 1876-1908*

Workhouse	Births inside marriage (a)	Deaths of infants born inside marriage (b)	Births outside marriage (c)	Deaths of infants born outside marriage (d)	IMR for births within marriage (b/a)*1000	IMR for births outside marriage (d/c)*1000
Hollingbourne, Kent 1876 - 1888	11	0	41	7	0	170
Heigham, Norfolk 1891	4	1	18	1	250	55
Lyncombe & Widcombe, Somerset 1892, 1900-1906	23	3	59	13	130	220
Loughborough, Leicestershire 1888-1908***	24	3	80	21	125	262
Total	62	7	198	42	112	212

*** Note: These figures include those for 59[A] Regent Street

Source: Data from the Open University Project: Vaccination and Infant Death Registers 1871-1910 (Cattell, 1999) - Hollingbourne (Clarke, G/Hb/NPv/1/1) Heigham (Coleman, uncatalogued) Lyncombe & Widcombe (Hack, PL834-842).

The total infant mortality rate for the various workhouses was 112 deaths per 1,000 births for the 62 births within marriage and 212 deaths per 1,000 births for the 198

births taking place outside marriage, nearly double the risk. It is not known how many of the births within marriage in the workhouses for other project areas were to workhouse employees, who may have been, comparatively, quite well off. This would not be the case for the majority of the births within marriage that occurred there. Thus it does not appear that giving birth in the workhouse imposed its own risks, but mothers giving birth outside marriage were likely to be at a particularly low ebb, socially and economically, their legal status being of little account. What we cannot tell is if there was a difference in the quality of care received by the mothers around and at the time of the birth, especially if, as in Loughborough, some of them were members of staff.

From Table 7.5 (below) we learn that the mothers who gave birth in the workhouse to children outside marriage were for the most part employed as domestic servants or in the hosiery trade - where, that is, an occupation was given in the vaccination register. From 1904-10 there was only one birth recorded as taking place in the workhouse and that was of a child of the Master. This does not mean that no births took place there; rather they were registered at 59A Regent Street[3]. During the period, 34 births and 10 of

---

[3] This was a response to a directive from the Registrar General, outlined in the Loughborough Workhouse Minute Book for 1904-1908, to omit direct reference to the Workhouse when recording the births of children in poor law institutions:

Registration of Births in Workhouses

The Clerk read a letter from the Registrar General stating that on the application of a considerable number of Boards of Guardians he has applied to and has now received the sanction of the Local Government Board to alter the regulations of the Registrars of Births and Deaths in such a manner as to authorize them to omit all direct reference to the Workhouse in future entries recording the Births of Children in Poor Law Institutions and to describe the place of birth in such alternative manner as may be approved by him. The Registrar General pointed out that this change of practice has been proposed and sanctioned in the interests of those children who are unfortunate to be born in a Workhouse, and the desirability of the change would no doubt be fully recognised by the Guardians.

It was resolved that No 59[A] Regent Street Loughborough be suggested to the Registrar General as the description and address of the Workhouse for future adoption in Column 1 of the Birth Register. (Workhouse Minute Books 1904-1908:17).

Regent Street ran alongside the Workhouse in Loughborough. 59A Regent Street may have been fictitious (it did not exist in the 1891 or 1901 census), or a side entrance to the workhouse.

the infant deaths were registered as taking place at this address. Of these, 20 births and 9 deaths were the children of unmarried mothers (14 births and one death being to married mothers). While all of the *births* were registered at 59a Regent Street, there is no apparent explanation for five of the deaths (two within and three outside marriage) being registered at the workhouse and the remaining four being registered at 59a Regent Street.

Table 7.5 *Occupations for the mothers of births outside marriage in the Loughborough workhouse, 1888 – 1910*

Occupation	Births	Deaths
Domestic Workers		
Governess	1	
Domestic & General Servant	21	5
Charwoman	3	
Laundry Maid	1	
Total	26	
Hosiery Workers		
Factory Hand	15	4
Framework Knitter	1	1
Seamer of Hosiery	6	
Winder of Hosiery	1	
Machinist	1	
Total	24	
Unemployed		
No occupation given	10	2
Total	60	12

Source: Vaccination and Infant Death Registers.

The IMRs for births registered at 59A Regent Street did not follow the trend of decline from 1907 in the Loughborough Urban District. From 1905-1910 they were much higher than for births registered at the workhouse from 1888 – 1904, albeit the numbers in the twentieth century were small. All births registered at this address had an IMR of 352 deaths per 1,000 births. Of this group, births within marriage experienced an IMR of 214, and births outside marriage one of 529, deaths per 1,000 births. When the Regent Street births were added to those of the workhouse, the IMR increased by 84 deaths per 1,000 births to 255 but this still compared favourably with the overall rate of

283 deaths per 1,000 births for all births outside marriage in the Loughborough Sub-registration District. Of the mothers who gave birth outside marriage using the 59A Regent Street address, thirteen said they were domestic servants, six were hosiery workers and only one gave no occupation.

Perhaps the most interesting cluster of births outside marriage was the one in Cambridge Street, Loughborough. Between 1888 and 1910, there were 32 births and four deaths registered at number 31 Cambridge Street: an IMR of 125 deaths per 1,000 births. Twenty of these were births outside marriage, of which three did not survive. Seven births were to the head of the household; one of these died. With an IMR of 150 deaths per 1,000, the infants born outside marriage at this address would appear to have a had a much better survival rate than those registered at either the workhouse in the nineteenth century or 59A Regent Street in the twentieth; in fact, no deaths occurred at the Cambridge Street address in the twentieth century. This household appears to have been unique in providing accommodation for unmarried mothers in the sub-registration district, although some legitimate births were also registered there.

According to the census enumerator's book in 1891, this Cambridge Street household was headed by Sam Hull, a coal carter aged 34. He lived there with his wife, aged 31, and their two sons aged eight and two. Also in the house were two boarders, male infants aged eight months and two months, and a lodger aged 25 working as an ironmonger's assistant. The vaccination registers tell us the mother of the two-month-old child boarder, born in January 1891, was a parlour maid; the father of the older infant boarder, born in July 1890, was a traveller. Both registered their births at the Cambridge Street address. Neither the origins nor the location of the parents of these

infants are known. Table 7.6 lists the occupations of the fathers of births within marriage that took place at Cambridge Street.

Table 7.6 *Father's occupation for births within marriage, 31 Cambridge Street, Loughborough, 1891 – 1910*

Occupation	Births	Deaths
Carter (Sam Hull)	7	1
Hardware manufacturer	1	
Pattern maker	1	
Teacher of science	1	
Twist hand	1	
Traveller	1	
Total	12	1

Source: Vaccination and Infant Death Registers.

Table 7.7 *Occupations of mothers giving birth at 31 Cambridge Street, Loughborough, 1891 – 1910*

Occupation	Births	Deaths
Housekeeper	2	
Parlour Maid, Housemaid	3	
Domestic Servant	2	1
Waitress	1	
Dairy assistant, milkman's assistant	2	
Canvasser	1	
Dressmaker	1	
Teacher of music	1	
No occupation given	4	2
Total	20	3

Source: Vaccination and Infant Death Registers.

While a large proportion of mothers giving birth at the workhouse and Regent Street named menial hosiery or domestic work, many of those at Cambridge Street gave higher status job titles and the majority of other lodgers were from socio-economic group III or higher (see Table 7.7). Thus, the Cambridge Street household should not

have been a disreputable establishment. At this time a birth outside marriage for an otherwise respectable girl affected the reputation of the entire family. Number 31 Cambridge Street may, therefore, have provided a haven for such girls if the family had no relatives to whom she could be sent. Mrs Hull may have had, or acquired, some midwifery skills. Whether the refuge was founded on altruistic or business grounds is not known. However, in the vaccination registers, Sam Hull gave his occupation at the birth of his seven children, chronologically, as carter, labourer, labourer, carter, joiner, carter and carter. These occupations suggest the lodgers were more of a necessity than an indulgence. It is not known if any women or couples lodged there without giving birth.

While data from the vaccination registers provided a fascinating insight into the provision for the care of infants born outside marriage in the Loughborough Urban District, the proportion of births in all three clusters was very small and so had little impact on infant mortality rates overall.

THE INFANT MORTALITY OF TWINS

Birth was always a perilous time for both mother and child in the past but far more so if she were carrying more than one child. Twins and triplets were far less likely to survive than other children and their mothers also suffered a greatly increased risk of death. (Wrigley *et al* 1997:242)

The twin mortality rate for the 330 births in the Loughborough Sub-registration District, for the period 1888-1910, was 496. During a period when the overall mortality rate was 142 the risk of death for twins was almost three and a half times greater than for single births. Unlike earlier studies of multiple births (e.g. Galley 1993; Wrigley *et* al:1997), the Loughborough data does not suffer from the possibility of under-registration, for which it is difficult to compensate.

Here again we are dealing with small numbers. Multiple births form only a very tiny proportion of total births, between five and fourteen instances in any single year in the Loughborough Sub-registration District, so what happened to them had very little impact on the overall infant mortality rate. Here, between 1888-1910, only one in 57 births was a twin birth. This was considerably less than the ratio of multiple births in surrounding periods. In the twentieth century, Botting *et al* (1990) calculated ratios of 1:83 for the period 1941-1945 and 1:92 for the period 1986-1989. For mid-twentieth century England the Registrar General recorded one in 85[4]; Galley (1993:74) suggested a range, for most western countries in the nineteenth century, of one in every 80-100 births; in Wrigley's reconstitution data for the period 1541 –1871, the ratio was one in 74 births.

Table 7.8 *Survival of twins born in the Loughborough Sub-registration District, various periods, 1888 – 1910*

Year	No of twins born	No of infants dying	No of infants surviving	No of single twin surviving only	No of both twins surviving
1888 - 1910	330	170	160	45	116
% surviving				28	72
IMR		515			
1888 - 1900	180	94	86	26	60
% surviving				30.2	69.8
IMR		522			
1901 - 1910	150	75	75	19	56
% surviving				25	75
IMR		500			
1901 - 1906	100	53	47	11	36
% surviving				23.4	76.6
IMR		530			
1907 - 1910	50	22	28	8	20
% surviving				28.6	71.4
IMR		440			

Source: Vaccination and Infant Death Registers.

[4] Registrar-General's *Statistical Review of England and Wales:* Tables Part II Civil, tab DD

Table 7.8 shows the fate of twins at various periods from 1888-1910 in the Loughborough Sub-registration District. Given the relatively small numbers involved, the infant mortality rates, at around 500 deaths per 1000 births, and the ratio of one or both twins surviving, in the region of 25:75, appear remarkably consistent in the twentieth century, with a small improvement having occurred in the number of both twins surviving from the last decade of the nineteenth century.

In the Loughborough Sub-registration District, neonatal males had a poorer rate of survival than females at an early age, but were less at risk in the post-neonatal stage (Table 7.9). These differences were perhaps part of a trend described by the Registrar-General (1908:xliii), who observed that

> the excess of male over female mortality from "immaturity"…steadily increased, in the period under review, from 22 per cent in the quinquennium 1886-1890 to 27 per cent in the year 1908.

However, in the Loughborough Sub-registration District the differences between male and female neonatal and post-neonatal IMRs were not significant.

Table 7.9 *Total, neonatal and post-neonatal infant mortality rates for twins born in the Loughborough Sub-registration District 1888–1910*

Sex	Infants born	Births outside marriage	Number of deaths		Infant mortality rate		
			<1month	<1year	Neonatal	Post-neonatal	Total
Male	173	14	49	45	**283**	**260**	**543**
Female	157	8	27	43	**171**	**273**	**445**
unknown	3						
Total	330		76	88	**230**	**266**	**496**

Note: Figures in red indicate a significant difference at a level of five per cent was found. The neonatal and post-neonatal IMRs are significantly different to a level of five per cent from the total IMRs, but not between themselves

Source: Loughborough Sub-registration District (compiled from vaccination registers).

It was noted above that there was a remarkably consistent pattern over time in the mortality rates of twins in the Loughborough Sub-registration District (see Table 7.8 above). The same appears to be true in Table 7.10[5], when the mortality rates of male and female twins are examined for each of the three areas that made up that district for

Table 7.10 *Male, female, and total,* b*irths, deaths, and infant mortality rates by gender of twins in the districts forming the Loughborough Sub-registration area, 1888–1910*

	Ratio	Births	Deaths	IMR
Shepshed Urban District				
Male		39	24	**615**
Female		25	8	**320**
Total		64	32	500
Ratio	1:52			
Loughborough Urban District				
Male		112	59	526
Female		116	56	482
Total		228	115	504
Ratio	1:60			
Loughborough Rural District				
Male		22	12	545
Female		16	6	375
Total		38	18	473
Ratio	1:44			

Note: Figures in red indicate a significant difference occurred at a level of five per cent between male and female IMRs

Source: Vaccination and Infant Death Registers.

[5] The following periodic analysis is included for interest only, due to the small numbers involved.

Births, deaths and infant mortality rates of twins by gender in the districts forming the Loughborough Sub-registration District, 1888–1899 and 1900–1910

	1888-1899			1900-1910		
	Births	Deaths	IMR	Births	Deaths	IMR
Shepshed Urban District						
Male	19	12	631	20	12	600
Female	11	4	363	14	4	285
Total	30	16	533	34	16	470
Loughborough Urban District						
Male	57	28	491	55	31	563
Female	53	25	471	63	31	492
Total	110	53	481	118	62	525
Loughborough Rural District						
Male	10	5	500	12	5	583
Female	9	3	333	7	3	428
Total	19	8	421	19	8	526

Source: Vaccination and Infant Death Registers.

the period 1888-1910. In each case the overall IMR was around 500 per 1000 with males having higher rates of mortality than females. However, in the Loughborough Urban District the gender difference was slight while in the Shepshed Urban District the difference was statistically significant.

The gender difference in surviving a mixed sex multiple birth was statistically significant at a level of five per cent (Table 7.11). In the Loughborough Sub-registration District, while male infants had a better chance of surviving in same sex pairs than in mixed sex pairs, male same sex pairs did not fair so well as single sex female pairs. There was no significant difference in the infant mortality rates for all female and all male pairs.

Table 7.11 *The births, deaths and infant mortality rates by gender for all twins and for twins born within marriage (BWM), in the Loughborough Sub-registration District, 1888-1910*

	FF		FM		MF		MM	
	Births	Deaths	Births	Female Deaths	Births	Male Deaths	Births	Deaths
Total	98	45	59	24	59	38	114	62
IMR		459		**406**		**644**		543
BWM	94	43	55	22	55	34	104	54
IMR		457		**400**		**618**		519

Key: F – female M – male

Note 1: These figures concern numbers of births not birth events. Four sets of twins are detailed to give the incidence of mortality to both females and males in mixed sex pairs.

Note 2: Figures in red indicate a significant difference at a level of five per cent between female and male IMRs in mixed sex pairs.

Source: Vaccination and Infant Death Registers.

The removal of births outside marriage made less difference to the rate for female twins than for male twins. This may be a reflection of the overall trend described by the Registrar-General (1911:xxxvii), in which the excess in the mortality of males was

greater in the first months of life, and thereafter regularly decreased. Since the lifespan of multiple births tends towards brevity, the majority would fall into the period when male mortality was known to be higher.

THE SEASONALITY OF INFANT MORTALITY

In late nineteenth century England certain diseases were especially prevalent at particular times of the year leading to peaks and troughs in the number of deaths brought about by them. Diarrhoea was one of these, being a major killer of infants, especially in urban areas. In the 1890s major outbreaks were sufficiently powerful to raise the percentage of annual deaths occurring in the third quarter of the year in the country as a whole to almost 40 (See Table 7.12 below). Table 7.12 shows the quarterly distribution of infant deaths in the Loughborough Sub- registration District from 1871-1910. A perusal of the table reveals that summer (third quarter) peaks occurred throughout the period and especially so in the 1890s, thus reflecting the national picture. In 1893 and 1906, third quarter deaths accounted for almost 50 per cent of annual deaths. In both of these years the MOH for the Loughborough Urban District reported on an outbreak of deaths from diarrhoea to which were added deaths from respiratory diseases in 1893. A rise in diarrhoeal deaths in the Loughborough Rural District in 1893 was also noted.

When quarterly deaths were examined in the two urban areas of the Loughborough Sub-registration District, quite different patterns emerged (Table 7.13). In the Loughborough Urban District the July-September quarter was clearly the major season of deaths, followed by the January-March quarter. In the Shepshed Urban District the position was reversed. This would suggest that the level of urbanisation in the

Table 7.12 *Infants deaths per three months as a percentage of total deaths*: *Loughborough Sub-registration District, 1871–1910*

Quarter:	1st	2nd	3rd	4th
1871	18.97	20.69	25.00	35.34
1872	26.27	19.49	31.36	22.88
1873	28.76	22.88	22.88	25.49
1874	22.79	20.59	32.35	24.26
1875	23.13	23.88	29.85	23.13
1876	20.28	16.08	30.07	33.57
1877	31.43	18.57	25.00	25.00
1878	25.20	20.47	37.01	17.32
1879	25.62	30.58	15.70	28.10
1880	16.42	19.40	44.03	20.15
1881	20.77	20.77	36.92	21.54
1882	26.13	18.02	28.83	27.03
1883	19.49	22.03	30.51	27.97
1884	25.00	19.35	29.84	25.81
1885	30.00	20.00	28.18	21.82
1886	29.37	13.99	20.98	35.66
1887	28.57	27.07	27.82	16.54
1888	25.44	23.68	22.81	28.07
1889	25.32	24.68	29.75	20.25
1890	29.13	19.69	26.77	24.41
1891	23.48	26.52	26.52	23.48
1892	27.48	23.66	28.24	20.61
1893	13.33	25.19	48.15	13.33
1894	35.66	16.78	24.48	23.08
1895	20.39	18.42	42.11	19.08
1896	30.33	19.67	22.95	27.05
1897	30.89	13.82	38.21	17.07
1898	31.03	13.79	39.31	15.86
1899	17.86	16.96	38.39	26.79
1900	18.83	20.78	39.61	20.78
1901	24.32	18.92	31.53	25.23
1902	39.29	28.57	15.18	16.96
1903	21.62	21.62	30.63	26.13
1904	31.78	16.82	29.91	21.50
1905	26.98	24.60	26.98	21.43
1906	22.92	12.50	48.61	15.97
1907	31.73	21.15	13.46	33.65
1908	27.68	21.43	22.32	28.57
1909	12.31	30.77	29.23	27.69
1910	39.34	16.39	22.95	21.31

Note: The figures for these calculations are given in Appendix 3

Source: Registrar General's *Quarterly Returns*, calculated by Michael Drake, unpublished paper.

Shepshed Urban District was not sufficient to bring about deaths from diarrhoea to the extent that it did in the Loughborough Urban District.

Table 7.13 *The seasonality of infant deaths in the Shepshed and Loughborough Urban Districts 1888-1911 for all causes*

Index = 100 (i.e. total deaths distributed by quarter in proportion to the number of days in each quarter)

Urban District	Number of deaths	January -March	April-June	July-September	October-December
Shepshed	474	137	93	95	75
Loughborough	2196	101	75	134	90

Note: The small number of in-migrant deaths was not included in this data but data from the infant death register for 1911were transcribed for this analysis.

Source: Infant Death Registers.

To see whether any change occurred in the distribution of deaths across the year, the figures in Table 7.13 were broken down into those occurring from 1888-1900 and from 1900-1910 (see Table 7.14 below). The pattern in the Shepshed Urban District remains more or less the same. In the Loughborough Urban District, however, the summer peak was much reduced in the second of the two periods, which suggests that summer diarrhoea was having a smaller impact on infant mortality[6].

[6] Analysis of the seasonality of death produced an interesting pattern of change that coincided with the opening of the new Loughborough reservoir on September 12th 1906. The table below presents the figures for a four-year period before and after the change of water supply. At first sight it appears that the number of deaths in the July-September quarter fell by two thirds. However, the large size of this fall is partly due to a peak of 60 deaths that occurred in July-September 1906. Even allowing for this, the reduction is still greater than the one in the following quarter. Analysis of the deaths that occurred before and after September 12th, and in October 1906, shows there were more than double the number of deaths in the 3-6 month age range than the 7-11 months age range between September 1st and September 12th. From September 13th to September 30th, and for the whole of October 1906, there are very similar numbers in both the 3-6 and the 7-11 months age ranges. Analysis of the deaths that occurred before and after September 12th, and in October 1906, shows there were more than double the number of deaths in the 3-6 month age range than the 7-11 months age range between September 1st and September 12th. From September 13th to September 30th, and for the whole of October 1906, there are very similar numbers in both the 3-6 and the 7-11 months age ranges. Analysis of the deaths that occurred before and after September 12th, and in October 1906, shows there were more than double the number of deaths in the 3-6 month age range than the 7-11 months age range between September 1st and September 12th. From September 13th to September 30th, and for the whole of October 1906, there are very similar numbers in both the 3-6 and the 7-11 months age ranges. There were necessarily extremely small numbers of data for this analysis and no causal conclusions can be drawn. They are discussed, however,

Table 7.14 *The seasonality of infant deaths in the Shepshed and Loughborough Urban Districts, all causes, 1888–1900 and 1901-1911*

Index = 100 (i.e. total deaths distributed by quarter in proportion to the number of days in each quarter

Urban District	Period	Number of deaths	January-March	April-June	July-September	October-December
Shepshed	1888-1900	277	129	96	96	80
	1901-1911	197	148	90	95	69
Loughborough	1888-1900	1349	97	73	144	86
	1901-1911	847	106	80	118	96

N.B. In-migrant deaths were not included

Source: Infant Death Registers.

As noted above diarrhoeal deaths did occur in the Shepshed Urban District but they were fewer proportionately than in the Loughborough Urban District. A summer peak occurred in the Shepshed Urban District in 1900, with eight of the fourteen deaths in that quarter occurring in August. However of the 35 deaths in the year as a whole, only five were ascribed by the MOH as having been due to diarrhoea. In the period 1900-10, some 17 per cent of the deaths in the Shepshed Urban District were said by the Leicestershire County MOH to have been caused by diarrhoea and enteritis (CMOH 1900-10).

Part of the explanation of the general absence of a summer peak in mortality in the Shepshed Urban District during the period of study may have been due to its position

because the patterns they present may initiate further research.

The seasonality of death for infants before and after the new reservoir was completed, Loughborough Sub-registration District, comparing the years 1903-1906 and 1907-1910

	Infant Deaths – Loughborough Sub-registration District	
Quarter	**1903-1906**	**1907-1910**
July - September	142	48
October- December	85	72

Source: Vaccination Infant Death Registers.

above the Soar valley. Williams (1992) remarked on an analogous situation in Sheffield where the peak was especially noticeable in the low lying areas near the river whilst where 'the steep valley sides encouraged better drainage, the summer peak in mortality was much less marked' (Williams 1992: 87).

THE RELATIONSHIP BETWEEN INFANT MORTALITY AND RATEABLE VALUES

Occupation of household head as a means of determining socio-economic status has a number of drawbacks, some of which have been noted above. The practice persists partly because of its relative simplicity and partly because length of use has endowed it with a certain legitimacy. There is, however, another way of realising the same aim and that is to use the rateable value of domestic properties or, even better, the rents paid for them. In the period covered by this study over 90 per cent of the population lived in rented accommodation. Moving between houses was relatively easy and quick. One advantage of using rateable values – here taken as a surrogate for rents – is that it takes account of family income and relates the infant to its place of birth.

Two enumeration districts of similar size were chosen from the 1891 census, one close to the flood plain in the east of the town, the other away from it in the west (Figure 7.4). The idea was to test the hypothesis that infant mortality would be lower away from the river than near to it on the grounds that living in the former area would be more salubrious than in the latter. A second hypothesis was that the impact of location would be affected by the socio-economic status of the family, decided upon here by the rateable value of the property in which they lived. Thus the higher the rateable value, the lower the infant mortality. To test these two hypotheses three sets of data were used. First were the vaccination and infant death registers, which provided the births and

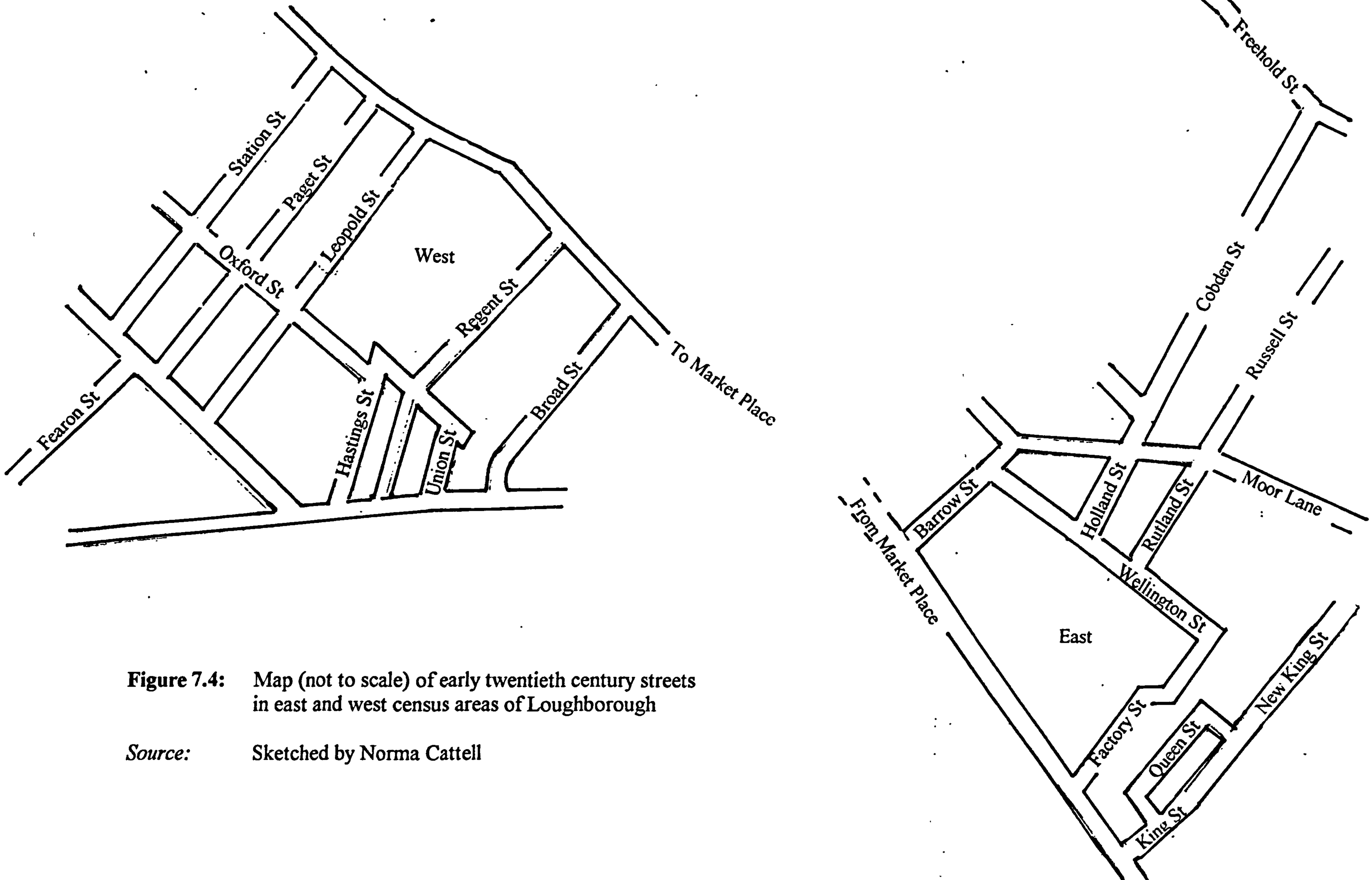


Figure 7.4: Map (not to scale) of early twentieth century streets in east and west census areas of Loughborough

Source: Sketched by Norma Cattell

deaths. Second were the census enumerators' books, which pinpointed the location of the properties where the births and deaths occurred. Third were the Land Duty Survey Books, which resulted from the Finance Act of 1909 and which gave the rateable values of those properties. As expected some problems arose. On occasion precise addresses were difficult to find, especially when the vaccination registers did not give house numbers. Families moved frequently but usually this was to another house in the same street or close by, with the majority of moves confined to the chosen areas. Locating properties in the five large volumes produced by the Land Duty Survey was not easy as the information they contained was ordered according to the owners not the location or inhabitants of the properties. Every page had to be searched for entries in the streets of the selected areas.

The poorest quality properties in Loughborough were in the courts and yards in the central parts of the town. Here houses of poor construction were closely packed and had few facilities. The Leicestershire County MOH remarked in 1897 that deaths from diarrhoea mostly occurred here. These areas, however, were outside the ones chosen for analysis here. A recent visual survey of the properties that concern us revealed that most were two-storey Victorian terraced houses, with a front door opening directly onto the street. A few of the houses in the western area had a very small front garden and may have accommodated the very small number of families in the area who belonged to SEG II. In the east they were terraced and again fronted onto the pavement.

Some of the houses in both the east and west areas dated back at least as far as the mid-nineteenth century, being located in the Local Government Board Report of 1849. These were John Street, King Street, Moira Street, Queen Street, Regent Street, Salmon

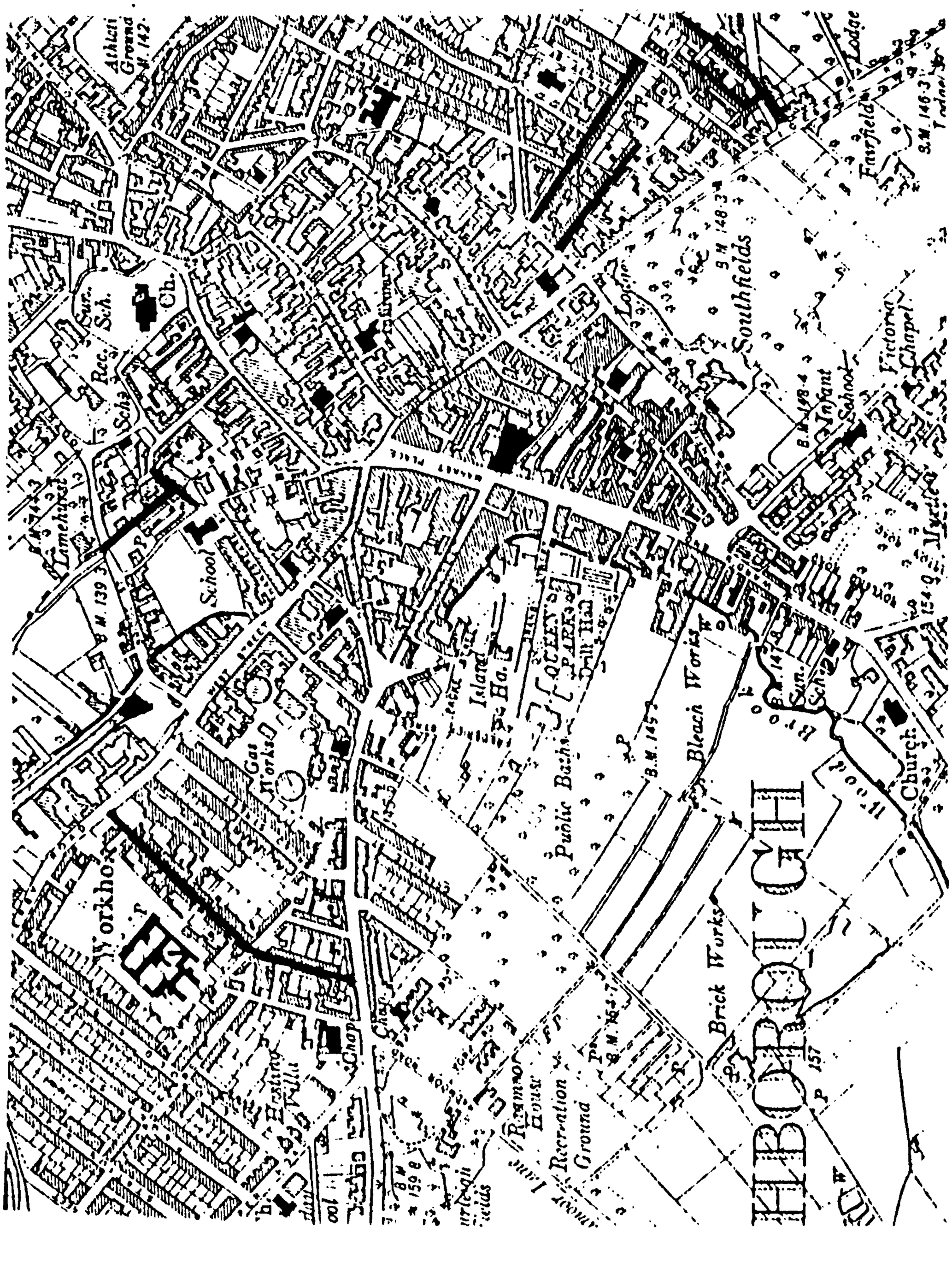


Figure 7.5 Map showing Streets (marked in black) built in Loughborough c. 1849

Source: Pick (1914)

Street, Union Street and Wellington Street (Figure 7.5)[7]. Infant mortality rates for these properties were calculated for various periods within the years 1888-1910 (Table 7.15). It will be seen that the rate fell in line with that for the town as a whole, although the rates were higher and the rate of decline slower.

Table 7.15 *Infant mortality rates 1888 – 1910 for a cluster of streets built in Loughborough prior to 1849 and for the Loughborough Urban District (LUD)*

Year	Births	Deaths	IMR	IMR in the LUD
1888-1899	633	121	191	163
1900-1910	372	118	175	128
1900-1906	426	79	185	145
1907-1910	246	39	158	97

Note: Due to the smaller numbers, events recorded at the workhouse and 59a Regent Street in Loughborough were excluded from the cluster data to avoid bias, as an unknown proportion of these deaths would have occurred to people originating from outside the area (see above)

Source: Vaccination and Infant Death Registers.

Table 7.16 (below) reveals that infant mortality rose as rateable values fell in both the eastern and western areas of Loughborough chosen for analysis here. There was, however, a much greater gap between the IMR of those living in properties valued below and above £8.0s.0d. Does this indicate that housing was in itself an important determinant of infant mortality or that, as hypothesised above, that socio-economic well-being (for which rateable values have here been taken as a surrogate) was an important determinant, especially when it was above a certain level? It was only possible to include those houses where a rateable value could be found in this analysis.

[7] The date of the housing analysed here is particularly relevant since Buck and Franklin (1875) reported that many of the houses in Leicester were being built on made-up ground in former clay-pits. Some sites they examined had clay being dug at one end and houses being built at the other, and in between the two operations all kinds of rubbish were deposited in order to make up the ground. In one example of such made-up ground they found a heap 'about six yards square, specially foul; consisting of wet ash bin refuse, rabbit skins alive with maggots, cabbage and other vegetable refuse, lemons...[and]...rope turnips' (Buck & Franklin 1875: 46-47). It is not known if this was also the practice in Loughborough, but at least one brickyard, Tucker's, was active and this industry would have created clay pits.

Table 7.16 *Infant mortality by rateable value in two areas of the Loughborough Urban District, 1888–1910*

	EAST			WEST		
Rateable Value	Births	Deaths	IMR	Births	Deaths	IMR
£8-<£10	542	62	**114**	909	111	**122**
£6-<£8	556	85	153	849	147	**173**
£3-<£6	395	66	**167**	317	60	**189**
Total	1493	213	142	2075	318	153

Note: Figures in red indicate a significant different at the level of five per cent against the value of £8-<£10.

Source: Vaccination and Infant Death Registers and 1910 Land Duty Survey Books.

Unlike analysis by socio-economic group, where for example licensed victuallers would be placed in group III, fathers paying a rateable value of more than £8.0s.0d. could be paying rates on a business or a public house, and not necessarily be in a higher social or monied position. The other conclusion to be drawn from Table 7.16 is that infant mortality was higher, for whatever reason, in the western area chosen for analysis than in the eastern. Proximity to the river[8] would not then seem to have had the effect hypothesised[9].

[8] Further investigation discovered the Loughborough sewage works was close to the chosen western census area: it is not know whether or not its proximity influenced infant mortality there.

[9] Given the difficulties of the source, it would make a separate project to find all addresses in the 1910 Land Duty Field Books in the town of Loughborough. However, it would be possible to reconstitute families using vaccination data and CEBs to put the infant into the context of its family and siblings. With the release of the CEBs for 1901, a 'snapshot' of one complete decade would be possible. Further study using the rateable values for all properties from the whole of Loughborough town could follow the increase and decrease of rateable values when families moved to indicate upward or downward mobility, and assess any effect on infant survival. The present study found that the hosiery and engineering industries experienced a significant difference between IMRs in the nineteenth and twentieth century but the difference in infant mortality for rail workers was not statistically significant. In an era before public transport, workers lived near to their place of employment. Rail workers would live close by the two railway stations, while engineering and hosiery workers would be spread throughout the town, living near to one of the several factories where they might be employed. Arguably, pollution from engineering and hosiery works had the potential to be more noxious to local inhabitants than the railway. Given a suitable area and using addresses from the vaccination registers, a map-pinning exercise could be undertaken to find where workers lived and to pinpoint possible hazardous areas. The urban districts of Shepshed and Loughborough were too compact for this to be a worthwhile exercise as workers living in any area would be able to walk easily to any factory in the district.

INFANT MORTALITY AND THE GEOLOGY OF SETTLEMENT SITES

Historically the gravel terraces along the edges of the Soar Valley were convenient places for settlement because, as Reid (1990:33) observed, 'whilst supplying water via shallow wells such sites were above the general level of flooding of the rivers'. As well as the town of Loughborough itself, the settlements of Thorpe Acre, Knighthorpe and Shelthorpe were terrace sites, as were Hathern, Dishley and Woodthorpe. Although these settlements are named separately in the vaccination registers, the small numbers of events recorded there are unsuitable for individual analysis. In modern times all settlements except Hathern have been absorbed into the town, but at the turn of the twentieth century these settlements were relatively rural.

In Chapter 3 we noted the similarity of the sites of those towns experiencing the highest infant mortality. In this section I shall look for significant periodic changes in infant mortality during the years 1888-1910 on the terrace sites in the Loughborough Sub-registration District. Was there an urban-rural gradient? Did any other settlements experience the decline of infant mortality from 1907 that occurred in the Loughborough Urban District? Did changes relate to the different geology of the site? Is there evidence from other parts of the country?

Table 7.17 shows infant mortality levels in the two selected areas of Loughborough town were very similar and all IMRs demonstrated an urban-rural gradient. The Shepshed Urban District and the group of all terrace sites presented a significant difference at a level of five per cent against the Loughborough Urban District but not against the two selected areas in the east or west. However, when the village of Hathern was taken alone, the difference was not statistically significant, although infant

Table 7.17 *A comparison of infant mortality for the years 1888-1910: various sites in the Loughborough Sub-registration District*

Place	Births	Deaths	IMRs
Loughborough U.D.	13856	2043	**147**
Loughborough - East Area	1766	264	149
Loughborough – West Area	2209	326	147
Shepshed U.D.	3381	454	**134**
Hathern	630	78	123
All terrace sites (including Hathern, excluding Loughborough town)	875	106	**121**
Long Whatton	288	31	107

Note: Figures in red were significantly different at a level of five per cent from the Loughborough Urban District

Source: Vaccination and Infant Death Registers.

mortality there was considerably lower than in the Loughborough Urban District. This village was the largest of the terrace sites in the hinterland of Loughborough town. It is to the north and equi-distant from both the Loughborough and the Shepshed Urban Districts.

Table 7.18 *A periodic comparison of infant mortality for the years 1888-1900 and 1901-1910: various sites in the Loughborough Sub-registration District*

	Births		Deaths		IMRs	
Place	**A**	**B**	**A**	**B**	**A**	**B**
Loughborough U.D.	7540	6046	1274	769	**168**	**127**
Loughborough - East Area	1045	721	185	79	**177**	**109**
Loughborough - West Area	1382	827	225	101	**162**	**122**
Shepshed	1955	1426	275	179	140**s**	125
Hathern	363	267	51	27	140	101
All terrace sites (including Hathern, excluding Loughborough town)	528	347	73	33	**138**	**95s**
Long Whatton	167	121	21	10	125	82

Key: Figures for the years *A*: 1888 – 1900; *B*: 1901 – 1910
Note: Figures in red were found to have a significant periodic change at a level of five per cent. The letter 's' denotes a significant difference with the Loughborough Urban District

Source: Vaccination and Infant Death Registers.

Table 7.18 presents a periodic comparison of the years 1888-1900 and 1901-1910. All areas experienced a fall in infant mortality in the twentieth century, which was significant for the selected areas and the urban district of Loughborough, and for the group of all terrace sites. However, the cross-century changes in the settlements of Shepshed, Hathern and Long Whatton were not statistically significant. During the period 1888-1900, the IMR for the Shepshed Urban District was significantly different from that of the Loughborough Urban District, and this was the case also for Hathern, but not until later, from 1901 to 1910. Further periodisation demonstrated more local differences[10] (see Table 7.19).

Table 7.19 *A second periodic comparison of infant mortality for the years 1901-1906 and 1907-1910: various sites in the Loughborough Sub-registration District*

Place	Births		Deaths		IMRs	
Period	**A**	**B**	**A**	**B**	**A**	**B**
Loughborough U.D.	3721	2325	545	224	**146**	**96**
Loughborough - East Area	459	262	60	19	**130**	**72**
Loughborough - West Area	542	285	72	29	132	101
Shepshed	900	526	89	61	***98s***	***115***
Hathern	153	114	16	11	104	96
All terrace sites (including Hathern, excluding Loughborough town)	198	149	19	14	95**s**	93
Long Whatton	68	53	5	5	***73s***	***94***

Key: Figures for the years *A:*1901-1906; *B*: 1907-1910
Note: Figures in red were found to have a significant periodic change at a level of five per cent. Italicised figures showed an increase in infant mortality. The letter 's' denotes a significant difference occurred with the Loughborough Urban District

Source: Vaccination and Infant Death Registers.

Between the two periods, 1901-6 and 1907-10, the difference in infant mortality was significant for the Loughborough Urban District and the selected east area, but not for

[10] It also meant that events in the smallest district reached close to the acceptable statistical minimum of 50.

the selected west area of Loughborough, although a substantial reduction occurred there. The Shepshed Urban District experienced a significant increase in infant mortality between these two periods, but although Long Whatton experienced an increase it was not statistically significant. This lack of significance relates back to my earlier discussion of the fallibility of significance testing (Chapter 1); these results cannot be judged in isolation, but within Matthews' (1998:23) remit of 'context, of prior knowledge, and plausibility'. In the final period, no district had a significant difference from the Loughborough Urban District.

It seems that here the periodic *increase* in infant mortality occurred in non-terrace sites, Shepshed and Long Whatton, while the *decline* occurred in gravel terrace sites. Long Whatton is to the north of Shepshed, on red marl and beds of sandstone. The geology of Shepshed, discussed above, also included sand. Sandstones are excellent water bearing strata and 'the proportion of organic elements in these waters is generally more moderate than that met with even in unpolluted surface waters' (BSP1874:464). In another area of the Open University Project, Birch used vaccination registers to study the Ampthill district of Bedfordshire. Ampthill experienced lower infant mortality than its surrounding villages, despite a very poor water supply and a greater population density. It was built on a hill made of sandstone, whereas many of the surrounding parishes were built on heavy clay (Drake & Razzell 1997:7). Birch (OU 1997:34) found little difference in infant mortality between parishes on clay and on sand, but a large difference for Flitwick, an area on gravel (see chapter 4) although these differences were not found to be statistically significant. However, if, as previously mentioned, we take Matthews (1998) 'context, prior knowledge and plausibility' into account, this could prove to be an interesting area for future research using national data.

THE GENDER DISTRIBUTION OF INFANT DEATHS

A hypothesis to test McKeown's theory of nutrition

In his Report for 1907, the Registrar-General (1907:cxxvii) observed 'all except the common infectious diseases are more fatal to boys than to girls'. Male infants were smaller and seemed more susceptible to diseases such as diarrhoea and bronchitis. At the end of the core period of this study, research performed on frogs and aphids in 1911 found that better feeding increased the numbers of females born. This contributed to a shift in the rationale for humans from 'an excess of male deaths...[being]...an inbuilt error of nature, to the more social problem of nutrition[11]' (Armstrong 1986:217-8).

Edmonds (1835:691) had already described the increased survival rate of females early in the nineteenth century. If more females were found to survive at the onset of the rapid secular decline of infant mortality, this would support McKeown's (1962, 1976) argument that nutrition was the key determinant of mortality decline in the nineteenth century. [McKeown did not prove that levels of nutrition did in fact increase.] A hypothesis can be tested, using vaccination register data. Taking the two theories that

(i) nutrition was the key feature in the sudden decline of infant mortality in the Loughborough Sub-registration District from 1907

and

(ii) when nutrition improves there are more female births

there should be a noticeable difference in the balance of male and female births from the year 1907 in the Loughborough Urban District, when infant mortality began its

---

[11] In Leicester Weir (1878:6) criticised the parents' young age at marriage, not only because 'boy and girl' marriages were the cause of 'baby farming, criminal measures to procure abortion, baby life insurance agencies, and a host of other...questionable procedures', but because the baby was 'fed with biscuits, bread sop, uncooked corn flour and arrowroot, in solution with cow's milk, just as it left the left the carrier's cart,...[and drugged with]...laudanum, cordials and soothing syrups.

rapid twentieth century decline. Although the results of such a hypothesis are of interest, several problems must be acknowledged. Firstly, this test assumes that the balance of female and male births would be affected in a similar way to that shown by the research on insects and animals. Secondly, it assumes that nutrition is the only possible explanation of such differences. Thirdly, McKeown's theory of nutrition concerns childhood rather than infant mortality. (The decline of infant mortality mainly occurred in the twentieth century while McKeown's study concerned childhood and older age mortality decline in the nineteenth century). Lastly, the year 1907 has the highest number of births in the study period, consequent on a reduction in the time allowed for registration under the Notification of Births Act. However, it seems improbable that parents would be more or less likely to delay notification for infants according to gender.

The numbers of male and female births for the two urban districts and the whole sub-registration district of Loughborough were counted in the vaccination birth registers for the years 1888 – 1910. Table 7.20 below presents the sex ratios for various periods from 1888 to 1910. Periodic data show that male births outnumbered female ones until the period of decline from 1907 in the Loughborough Urban District. However, the annual figures show this difference was produced by a change in the years 1907 and 1908 only. If better nutrition was responsible for an increased number of female births, then nutrition only improved during two of the years in the first decade of the twentieth century. Such a short-term improvement would be an unlikely determinant, or even the precipitant, of the rapid decline that, in fact, continued throughout most of the twentieth century. Furthermore, the theory of increased nutrition as a determinant of infant mortality decline is not supported by the poverty known to exist in the 1900s, when

many children in the Loughborough area were receiving meals from soup kitchens and walking barefoot (Deakin 1979:69). However, the Shepshed Urban District, which did not experience the fall in infant mortality from 1907, did not experience a similar change in the sex ratio.

Table 7.20 *Male and female births and sex ratios (males per 100 females) in the Loughborough and Shepshed Urban Districts and the Loughborough Sub-registration District, various periods, 1888-1910*

	Loughborough Sub-registration District			Loughborough Urban District			Shepshed Urban District		
Births	Female	Male	Sex ratio	Female	Male	Sex ratio	Female	Male	Sex ratio
1888 -1899	4873	4999	103	3600	3616	100	853	928	109
1900-1910	4477	4575	102	3309	3333	101	781	825	106
1900-1906	2871	3007	105	2122	2192	103	524	556	106
1907-1910	1606	1568	98	1187	1141	96	257	269	105

Source: Compiled from Vaccination Birth Registers.

The evidence, then, is contradictory. While investigations of breastfeeding (Huck 1997; Fildes 1998) have shown that an infant's diet made a substantial difference to its survival, gender differences appear to rule out a nutritional improvement as the key determinant of declining infant mortality. The point of decline in 1907 in the Loughborough Urban District was considered to be too early to reflect possible improvements to the milk supply. Woods (2000:291) also remains sceptical about the direct and immediate impact of pasteurisation and the bottling of milk on infant mortality at the turn of the century. He says:

> the improved quality of cow's milk could not on its own have generated such a substantial and dramatic change in infant life chances compared with the quality of drinking water and when set against the extent of breastfeeding. It also ignores the point made by Newsholme [1906] in his invective about house flies; even if the milk was pure when it first reached the shops and street, in the home it would quickly have become contaminated.

Holt (Flexner & Holt 1904:186) conclude that the fact

> [t]hat so many attacks [of diarrhoeal disease] were seen in nursing infants, shows that we must seek for some other mode of entrance of the specific organisms than with the milk. Possibly it may be the water[12]...[t]he practice of boiling water for the use of infants is seldom followed in the tenements, and water in some form was given to almost all the children. No special relation of the infection to any other food or any special kind of feeding could be discovered.

THE AGE DISTRIBUTION OF INFANT DEATHS

Table 7.21: *Mortality per 1,000 living at each age, 1889*

Area	0-3 months	3-6 months	6-12 months
England and Wales	286 (55%)	128 (25%)	103 (20%)
Leicestershire	338 (53%)	180 (28%)	118 (19%)

Source: Jones Table XLV (1894:45) Registrar-General's Report 1889.

Mortality was not evenly distributed across infancy as Table 7.21 shows[13]. The table shows that although infant death rates were higher, within each age group, in Leicestershire than in England and Wales, their distribution across the first year were very similar. In both areas, then, the first six months of life was far more threatening than the following six months.

For infants in the Loughborough Sub-registration District from 1888 to 1910, 56 per cent of deaths occurred before three months of age and 77 per cent before six months of age. Although not strictly comparable, these figures are very similar to those for

---

[12] The first public water supply in Loughborough used the Wood Brook to supply the reservoir at Nanpantan. This scheme was completed in 1870 and water was supplied to the town from the Nanpantan filter beds by gravitation. In those days, it supplied a population of 12,000 consumers with about 25 gallons per head per day, but due to population growth and water-consuming industries, water was frequently suspended in times of drought. The shortage of water was aggravated by one sixth of the supply being taken by only three customers, for trade purposes (Hodson 1898:8). In 1884 there was a water famine, and a temporary supply had to be obtained from the Burleigh Brook. Water data is scarce and the quality of this water is not known. However, calculations using the Registrar General's Quarterly Returns showed that, in 1884, there were 25 deaths per 1,000 births (an IMR of 165) more than the previous year and 33 deaths per 1,000 births (an IMR of 132) less in the following year.

[13] The figures in Table 7.22 are not deaths per 1000 births, but deaths per 1000 living in each age group. The latter is normally regarded as a less satisfactory measure.

England and Wales and Leicestershire (Table 7.21 above). In Table 7.22, we see that the proportion of deaths of infants up to the age of three months steadily increased from 1888-1910, which means, of course, that it steadily decreased for those aged three to twelve months. This suggests that the endogenous component of infant deaths was increasing at the expense of the exogenous. Table 7.22 also shows that this process was especially marked between 1903-1906 and 1907-1910.

Table 7.22 *Percentage of infant deaths occurring in the Loughborough Sub-registration District, various periods, 1888-1910*

Age at Death	1888-1892 %	1893-1898 %	1899-1902 %	1903-1906 %	1907-1910 %
0-6 months	78	78	80	77	83
0-3 months	51	56	57	58	64
3-6 months	27	22	23	19	19
7-12 months	22	22	20	23	17

Source: Infant Death Registers.

We have already seen certain differences in infant mortality between the two urban districts in the Loughborough Sub-registration District (Chapter 5 above). Further differences appear when we look at the deaths of infant over six months of age in the two urban districts. Table 7.23 shows that the above average proportion of infant mortality over six months of age in 1906, which MOH reports tell us was mainly due to diarrhoeal causes, only occurred in the Loughborough, not the Shepshed Urban District. Note too, that there was a sharp fall in the proportion of infant deaths occurring from 0-6 months in the Loughborough Urban District between 1906 and 1907-12, whereas in the Shepshed Urban District there was a sharp rise. It seems, then, that one of the reasons for the lack of decline in infant mortality in the Shepshed Urban District at the end of the study period was because it never had high infant mortality from diarrhoeal

causes, at least in the over six month age group, in the first place.

Table 7.23 *Percentage of deaths over six months of age in the Loughborough and Shepshed Urban Districts 1888 – 1906, 1907 – 1912, and the year 1906*

Years	Loughborough U.D. %	Shepshed U. D. %
1888 – 1906	22.5	25.0
1906	26.0	20.8
1907 – 1912	17.9	25.0

Source: Infant Death Registers.

In previous chapters we have seen the broad trends of change in infant mortality as demonstrated by analysis of the vaccination register data. In this chapter we have seen that underneath the broader trends there were smaller, more local patterns of change. It is these smaller changes that may, or may not, have occurred nationally and that may have contributed to a larger or lesser degree to the pattern of overall change in infant mortality. As researchers are effectively barred from doing work on the civil registers of births and deaths across the country as a whole, it is impossible to say to what extent the various local experiences of infant mortality as evidenced in this and earlier chapters, was repeated elsewhere. In the meantime, as in this thesis, recourse can be made in a limited number of areas to the vaccination and infant death registers.

8

Conclusion

Infant mortality in the late nineteenth and early twentieth centuries was much discussed at the time. Recently elements of that discussion have been taken up by a number of historians. Both sets of discussions have produced a variety of factors that appear likely to have had an impact on both the level and trajectory of infant mortality, as we have seen in the causal loop diagram that formed Figure 1.4.

Although much of the qualitative evidence drawn upon in these discussions has been local in origin, the quantitative evidence has, for the most part, come from the statistics produced by the Registrar General. These limit the discussion because they were published, again for the most part, at relatively high levels of aggregation. There has been no way round this because the Registrar General has chosen not to make available to researchers the individual level data contained in the civil registers of births and deaths.

In this thesis that particular obstacle has been overcome. For the vaccination and infant death registers created by the Vaccination Act of 1871 are partial transcripts of the civil registers of births and deaths. They would appear to be accurate transcripts, at least for the Loughborough Sub-registration District. In fact the infant mortality rates derived

from them appear to be more accurate than those produced by the Medical Officers of Health at the local and county level.

The infant death registers do not, however, give the cause of death – that was of no concern to the vaccination officer for whom the transcripts were prepared. For that, recourse has had to be made to the annual reports of the medical officers of health in the three administrative districts, which together made up the Loughborough Sub-registration District. That there were three medical officers of health, and that they each produced annual reports, has been of great value in exploring one of the major issues in the study of infant mortality, namely what precisely brought about differences in infant mortality rates between urban districts with different sized populations and rural districts.

The Loughborough Sub-registration District was made up of two urban districts – Loughborough and Shepshed – the former much bigger than the latter, together with the Loughborough Rural District. Previous work would indicate that the highest levels of infant mortality would be found in the Loughborough Urban District, the lowest in the Loughborough Rural District, with the Shepshed Urban District somewhere in between. This turned out to be the case for the study period (1888-1910) as a whole. However when annual rates were examined it appeared that the Shepshed Urban District occupied a somewhat anomalous position, for it began the period with the lowest IMR and ended it with the highest. The other two areas showed little change in the 1890s and then experienced a sharp fall in the 1900s, especially after 1906. The Shepshed Urban District, on the other hand, showed little sign of a falling IMR throughout the period as a whole. Indeed, if anything, it experienced a rise in the 1900s. It is suggested

that a possible cause of this lies in the industrial history of Shepshed. Over the period it suffered the loss of what had been its major industry – framework knitting carried out in the home or small workshop. Unlike the Loughborough Urban District, where there were other major industries and a factory based hosiery industry to turn to, one can imagine that there was much distress in Shepshed. Thus, although it suffered less from diarrhoeal deaths – a major killer in the Loughborough Urban District and the decline of which accounted for much of the fall in the IMR there – there is evidence, from the high level of deaths from 'other causes', that inadequate feeding, the result of economic distress, was what kept the IMR up in the Shepshed Urban District.

This hypothesis receives some support when infant mortality is related to class and occupation. For in the urban district of Shepshed, unlike that of Loughborough, there was a substantial fall in the number of births ascribed to Class III and a corresponding rise in the number in Classes IV and V. We would expect this to bring about a rise in the IMRs of the Shepshed Urban District. That did occur, but its seems to have been compounded by a rise in the IMRs of framework knitters – an important, if not the main, occupational group in Class III – and labourers, the main occupational group in Class V.

It appears then that, by basing research on the vaccination and infant death registers, we have been able to add substantially to the discussion of both the high level of infant mortality in the late nineteenth and its precipitous fall thereafter. This is because these registers, by providing individual level data, allow us to examine areas of our choosing, not those of the Registrar General, and to explore avenues that his aggregate data does not allow.

How to explain the continuing high level of infant mortality in the late nineteenth century and the beginning of its precipitous fall thereafter has been the central concern of both contemporaries and subsequent researchers. There have, however, been a number of other issues that have attracted attention. Some of these were discussed in Chapter 7. So far as the differential between the mortality of infants born inside and outside marriage is concerned, the investigation confirmed earlier findings. Children born outside marriage had a significantly lower chance of survival. Although their survival rate improved over the period 1888-1910, along with the general fall in infant mortality, the differential remained. Few children were born within the workhouse. But those that did appeared to have been less likely to die in infancy than those born outside. Interestingly, even within the workhouse it would appear that the differential between legitimate and illegitimate births was marked. This last conclusion was born out by a comparative study that drew on the findings of other members of the Open University project on infant mortality.

On a matter of social rather than demographic history, the vaccination and infant death registers proved invaluable in adding detail to two issues. The first concerned the increased sensitivity of the poor law authorities to the stigma attached to children who were born in the workhouse. Thus in Loughborough they responded to a government that allowed them to provide an alternative (fictitious?) address for children born inside the workhouse. The second was the discovery of a household that appeared to provide a haven for women giving birth outside marriage.

The vaccination and infant death registers make possible an analysis of multiple births. Studies by Wrigley (1997) and Galley (1993) for earlier periods showed that twins and

triplets suffered much higher infant mortality rates than did children who were born singly. This pattern was equally apparent in late nineteenth and early twentieth century Loughborough. Such births were relatively rare but, in spite of this, the mortality rate remained relatively stable. The erratic fluctuations one might have expected with small numbers did not occur.

Seasonality of death was a major focus of attention for contemporaries, principally because of the notorious summer peaks – attributed to diarrhoea – and their apparent inevitability in spite of all efforts to eradicate, or, at least, reduce them. Success did come, however, in the early twentieth century and this contributed significantly to the overall fall in infant mortality. The experience of the Loughborough Sub-registration District mirrored that of many other areas. Thus, for example, in 1893 and 1906 almost 50 per cent of all deaths occurred in the third quarter of the year. The summer peak, however, virtually disappeared in the first decade of the twentieth century. But, yet again, within the sub-district as a whole there were differences. The Shepshed Urban District did not suffer from summer peaks in mortality: the difference between it and the Loughborough Urban District in this regard was quite stark. Since it did not suffer it could not benefit from whatever brought about the eradication of summer peaks in infant mortality and so did not enjoy the diminution in infant mortality associated with that.

Although the vaccination and infant death registers can provide a much more nuanced picture of infant mortality than is possible from the statistics produced by the Registrar General, their value is enhanced when taken together with other sources. The MOH reports are one such source, as are Poor Law records, census enumerators' returns and

the works of contemporary writers. Another source is the Finance Act of 1909-10. This produced the rateable values of all individual properties together with descriptions of the size and condition of such properties. For the purpose of this thesis just the rateable values have been used. Calculating infant mortality rates for children born in properties of different values provides an alternative measure to socio-economic status based on occupation. Indeed it has been argued here that it may be a better measure since it avoids the qualitative judgements associated with the creation of socio-economic categories, and given the propensity to move quickly from one rented property to another with comparatively small changes in family income, a good indication of family well-being at the time of a child's birth. The exercise conducted on two districts in the town of Loughborough revealed that infant mortality rose as rateable values fell. It did not reveal that infant mortality was higher in the area closest to the flood plain of the River Soar as predicated: quite the reverse.

The writer of the passage quoted at the beginning of this thesis asserted that what caused a particular level of infant mortality was likely to be the product of a variety of factors. The strength of such factors and the way they interacted one with another would vary from place to place. It was by getting to understand how they varied and how they interacted that one would be able to bring down the level of infant mortality. Here the issue has not been the practical one of how to bring down infant mortality but how to explain it. The factors that determine the level of infant mortality are not in dispute. Indeed, as Woods and his colleagues remarked 'there is always a danger that in the late twentieth century we shall rediscover that which was well understood by contemporaries' (Woods *et.al.* 1989: 113). In fact neither contemporaries nor historians have gone much beyond listing and describing these factors, correlating them, and

asserting the dominance of one over all the others. Much has been learned in this way. But there has been much frustration arising from the awareness that correlation is not causation and that the answers probably lie in a multivariate type of analysis to which the available sources do not lend themselves. A typical example of this was the differences in infant mortality that occurred on gravel sites, for which no explanation is forthcoming from vaccination register data.

It has been argued here that an understanding of infant mortality can best be achieved by operating at as low a level of aggregation as possible, within meaningful communities not entities created for administrative convenience. This will not produce a national solution, but such a solution is probably a chimera. It has also been argued that understanding can best be achieved by operating with individual level data not pre-existing aggregates. The approach has its drawbacks; most notably that the units involved are likely to be small and so subject to random error. Nevertheless this thesis has, it is hoped, revealed a more nuanced picture of infant mortality, even if, at times, that picture has not been as clear as one would wish.

APPENDIX 1

List of known archives holding vaccination registers

1 Bath & North East Somerset Archive
2 Bedfordshire Record Office
3 Berkshire Record Office
4 Birkenhead Central Library
5 Birmingham City Central Library
6 Bromley Central Library
7 Cambridgeshire Record Office
8 Cheshire Record Office
9 Cornwall Record Office
10 Cumbria Record Office
11 Devon Record Office. Exeter
12 Devon Record Office, Barnstable
13 Doncaster Archives
14 Durham Record Office
15 Dyfed Record Office. Carmarthen
16 Dyfed Record Office, Aberystwyth
17 East Sussex Record Office
18 Essex Record Office
19 Flintshire Record Office
20 Glamorgan Record Office
21 Gwent Record Office
22 Gwynedd Record Office
23 Hammersmith & Fulham Archives
24 Hertfordshire Record Office
25 Huntingdonshire Record Office
26 Isle of Anglesey Record Office
27 Kent Record Office, Maidstone
28 Kent Record Office, Rochester
29 Lancashire Record Office
30 The Leicestershire, Leicester and Rutland Record Office
31 Lincolnshire Record Office
32 Greater London Record Office
33 Norfolk Record Office
34 Northamptonshire Record Office
35 North East Lincolnshire Council Archive
36 Northumberland Record Office
37 North Yorkshire Record Office
38 Nottinghamshire Record Office
39 St Helens Local History Archives
40 Sheffield City Archives
41 Shropshire Record Office
42 Somerset Record Office
43 Staffordshire Record Office
44 Stockport Central Library
45 Suffolk Record Office, Lowestoft
46 Suffolk Record Office, Ipswich

47 Suffolk Record Office, Bury St Edmunds
48 Surrey Record Office
49 Tyne & Wear Archives
50 Warwickshire Record Office
51 West Glamorgan Record Office
52 West Yorkshire Archive Service
53 York City Archives

(Drake and Razzell 1997:23-42)

APPENDIX 2

List of Vaccination Legislation

1 The Vaccination Act of 1840 *(An Act to Extend the Practice of Vaccination, 3 & 4 Vict c.29)*

2 The Vaccination Act of 1841*(An Act to Amend An Act to Extend the Practice of Vaccination, 4 & 5 Vict. c.32)*

3 The Vaccination Act of 1853 *(An Act Further to Extend and Make Compulsory the Practice of Vaccination, 16 & 17 Vict. c.100)*

4 The Act for Vesting in the Privy Council certain powers for the protection of the Public Health *(21 & 22 Vict. c.97)*

5 The Vaccination Act of 1861 *(An Act to Facilitate Proceedings before the Justices under The Acts relating to Vaccination 24 & 25 Vict. c.59)*

6 The Vaccination Act of 1867 *(An Act to Consolidate and Amend the Laws relating to Vaccination 30 & 31 Vict. c.84)*

7 The Vaccination Act of 1871 *(An Act to Amend the Vaccination Act 1867,34 & 35 Vict. c.84)*

8 The Vaccination Act od 1898 *(An Act to Amend the Law with respect to Vaccination 61 & 62 Vict. c.49)*

9 The Vaccination Act of 1907 *(An Act to Subsitute a Statutory Declaration for the Certificate required under Section Two of the Vaccination Act 1898, Of Conscientious Objection, 7 Edw. 8, c.31)*

10 Vaccination was abolished under *The National Health Service Act 1946 (9 & 10 Geo. 6 c.81)* although abolition did not come into force until 1948.

Drake and Razzell (1997:13-15)

APPENDIX 3

Comparative Data for Loughborough, Leicester and England & Wales 1871-1910

Year	Births - England	Infant Deaths - England	IMRs - England	Births - Loughborough	Infant Deaths - Loughborough	IMRs - Loughborough	Births - Leicester	Infant Deaths - Leicester	IMRs - Leicester
1871	771,325	124,523	161	678	116	171	3,946	957	242
1872	824,646	123,258	149	676	118	174	4,152	963	231
1873	831,809	123,811	149	674	153	227	4,449	934	209
1874	854,307	128,730	151	737	136	184	4,373	944	215
1875	850,187	134,294	158	720	134	186	4,260	1,045	245
1876	887,464	129,537	146	756	143	189	4,783	956	199
1877	879,002	120,611	137	823	140	170	4,751	893	187
1878	891,418	136,051	153	775	127	163	4,779	984	205
1879	882,866	119,808	136	805	121	150	4,697	879	187
1880	872,397	134,801	155	822	134	163	4,857	1,064	219
1881	883,508	115,100	130	815	130	159	4,709	953	202
1882	888,940	125,147	141	836	111	132	4,855	934	192
1883	889,815	122,303	137	839	118	140	4,813	906	188
1884	908,574	133,577	147	751	124	165	4,851	1,107	228
1885	893,694	123,317	138	832	110	132	4,682	897	191
1886	903,216	135,084	150	866	143	165	4,859	1,034	212
1887	886,017	128,436	145	814	133	163	4,695	980	208
1888	879,263	120,127	137	821	114	138	4,819	952	197
1889	885,160	127,486	144	848	158	186	4,789	969	202
1890	878,347	131,535	150	804	127	157	4,697	930	197
1891	913,836	135,998	149	798	132	165	4,765	1,025	215
1892	897,270	132,603	148	816	131	160	5,816	1,142	196
1893	914,182	145,297	159	801	135	168	6,006	1,320	219
1894	889,239	121,918	137	799	143	178	5,994	975	162
1895	921,860	148,305	161	847	152	179	5,962	1,229	206
1896	917,201	135,487	148	885	122	137	6,104	1,141	186
1897	921,104	143,814	156	779	123	157	6,232	1,272	204
1898	922,873	148,249	161	819	145	177	6,225	1,160	186
1899	928,640	151,218	163	860	112	130	6,273	1,224	195
1900	926,154	142,943	154	835	154	184	6,207	1,085	174
1901	929,270	140,711	151	811	111	136	6,169	1,079	174
1902	877,400	116,638	133	832	112	134	6,314	966	152
1903	881,919	115,976	132	846	111	131	6,018	961	159
1904	877,784	127,538	145	809	107	132	5,941	1,096	184
1905	862,557	109,816	127	858	126	146	5,888	869	147
1906	867,920	114,773	132	882	144	163	5,865	984	167
1907	856,971	99,978	117	894	104	116	5,481	707	128
1908	867,285	104,168	120	849	112	131	5,366	669	124
1909	844,353	91,618	109	732	65	88	5,606	721	128
1910	828,239	86,732	105	710	61	85	5,327	659	123

Key: Blue indicates a significant difference was found between the IMRs for Loughborough and Leicester, Yellow a significant difference between Loughborough and England, at a level of five per cent

Source: The Quarterly Returns of the Marriages, Births and Deaths of England by the Registrar General; Leicester figures compiled by the author, Loughborough and England from the Quarterly Returns by Michael Drake (unpublished paper).

APPENDIX 4

Births, Deaths and IMRs in Loughborough Sub-registration District
1888 - 1910

Year	Loughborough Sub-registration District			Loughborough Urban District			Shepshed Urban District			Loughborough Rural District		
	Births	Deaths	IMR	Births	Deaths	IMR	Births	Deaths	IMR	Births	Deaths	IMR
1888	831	127	152	616	76	**123**	143	37	258	72	14	194
1889	829	135	162	596	113	**189**	157	12	76	76	10	131
1890	810	118	145	613	94	153	127	14	110	70	10	142
1891	812	135	166	579	98	169	155	28	180	78	9	115
1892	790	122	154	579	98	**169**	134	18	134	77	6	77
1893	813	135	166	578	107	**185**	167	19	113	68	9	132
1894	787	135	171	588	98	166	126	24	190	73	13	178
1895	851	135	158	621	107	**172**	162	18	111	68	10	147
1896	880	133	151	627	100	159	178	23	129	75	10	133
1897	779	133	170	591	110	186	119	15	126	69	8	115
1898	831	125	150	603	95	157	161	17	105	67	13	194
1899	849	115	135	626	86	137	152	21	138	71	8	112
1900	837	135	161	593	92	155	170	35	205	74	8	108
1901	817	123	150	586	95	162	156	19	121	75	9	120
1902	823	86	104	608	69	**113**	151	14	92	64	3	46
1903	847	116	136	607	91	149	169	18	106	71	7	98
1904	832	108	129	621	76	122	140	25	178	71	7	98
1905	836	128	153	623	99	158	148	20	135	65	9	138
1906	886	134	151	676	105	155	136	22	161	74	7	94
1907	902	94	104	664	67	100	150	20	133	88	7	79
1908	826	80	96	615	58	94	132	9	68	79	13	164
1909	737	81	**109**	532	60	112	125	17	136	80	4	50
1910	709	61	86	517	41	79	119	15	126	73	5	68

Note: Figures in red denote a significant difference occurred with the emboldened figures in the Loughborough Urban District or the sub-registration district overall

Source: Compiled from Vaccination Birth and Infant Death Registers by Norma A Cattell

APPENDIX 5 Analysis of Death by Cause - Loughborough Urban District

Loughborough Urban (N.B. Under 5 years)	Smallpox	Measles	Scarletina	Diptheria	Croup (not spasmodic)	Whooping Cough	Diarrhoea and Dysentery		Erysipelas	Puerperal Fever	Phthisis		Bronchitis Pneumonia & Pleurisy					Heart Disease	Injuries	All other Diseases	Total	Total Deaths Under 1 Year	% All Other Diseases of Total Deaths	% Premature Births of Total Deaths	% Bronchitis, Pneumonia etc of Total Deaths
1890		1			2	10	18		1		1		29						1	66	129	101	51.16		22.48
1891					3	4	11				2		24						1	75	120	93	62.50		20.00
1892		18	6	2		8	12						24					1	2	84	157	100	53.50		15.29
1893		4	11	2		8	38				1		26						2	74	166	116	44.58		15.66
1894				1		9	16				1		42						2	64	135	107	47.41		31.11
1895		19		3		1	26						18					2	4	84	157	115	53.50		11.46
1896		2		2		6	17				1		34					3	6	73	144	102	50.69		23.61
1897			1	7		9	24						20							71	132	100	53.79		15.15
1898		13	3	5		1	33						16					2	5	75	153	116	49.02		10.46
1899			1	2		3	18						15						2	62	103	84	60.19		14.56

Under 1 Year Deaths Loughborough Urban	Smallpox	Measles	Scarletina	Diptheria and Membranous Croup	Croup	Whooping Cough	Diarrhoea	Enteritis	Erysipelas	Puerperal Fever	Phthisis	Other Tubercular Diseases	Bronchitis	Pneumonia	Venereal Disease	Premature Births	Diseases and Accidents of Parturition	Heart Disease	Accidents	All other Diseases	Total		% All Other Diseases of Total Deaths	% Premature Births of Total Deaths	% Bronchitis, Pneumonia etc of Total Deaths
1900						6	31	1				3	4	4	1	8				59	117		50.43	6.84	6.84
1901		1				1	13	5				6	4			20		1	3	24	78		30.77	25.64	5.13
1902		2				10	5	2				10	9	8		15		2	1	26	90		28.89	16.67	18.89
1903	1	2				1	17	1				7	13	2	2	14	1			27	87		31.03	16.09	17.24
1904						4	21					3	7	7		10			3	28	83		33.73	12.05	16.87
1905		3					12	2				6	10		1	20	1		2	36	93		38.71	21.51	10.75
1906		3					44					1	9	5		9	3		3	28	105		26.67	8.57	13.33
1907		1				1	5	1				9	14	7		14	2		5	22	81		27.16	17.28	25.93
1908		1		1		4	16	2				6	7	2		16			3	19	77		24.68	20.78	11.69
1909						3	4					4	5	2		3			1	24	46		52.17	6.52	15.22
1910							3					2	11	1		5				17	39		43.59	12.82	30.77
1911		4					14					4	3	4		13			1	20	63		31.75	20.63	11.11

Source: Compiled from County MOH Reports held at Leicestershire Area Health Authority by N A Cattell

APPENDIX 5 Analysis of Death by Causes -Loughborough Rural District

Loughborough Rural (N.B. Under 5 years)	Smallpox	Measles	Scarletina	Diptheria	Croup (not spasmodic)	Whooping Cough	Diarrhoea and Dysentery		Erysipelas	Puerperal Fever	Phthisis		Bronchitis Pneumonia & Pleurisy				Heart Disease	Injuries	All other Diseases	Total	Total Deaths Under 1 Year	% All Other Diseases of Total Deaths	% Premature Births of Total Deaths	% Bronchitis, Pneumonia etc of Total Deaths	% Diarrheaol Deaths of Total Deaths
1890						3							1				1	1	12	18	15	66.67		5.56	0.00
1891													2						19	21	19	90.48		9.52	0.00
1892		3				1							3					1	13	21	18	61.90		14.29	0.00
1893							5						5						11	21	17	52.38		23.81	23.81
1894		1					1						3						15	20	14	75.00		15.00	5.00
1895		1				1							3					1	12	18	15	66.67		16.67	0.00
1896						1	2				1		3						14	21	16	66.67		14.29	9.52
1897				2		1	1						3					1	9	17	10	52.94		17.65	5.88
1898			3	3		1							2						15	24	18	62.50		8.33	0.00
1899							2						3						9	14	11	64.29		21.43	14.29

Under 1 Year Deaths Loughborough Rural	Smallpox	Measles	Scarletina	Diptheria & Membranous Croup	Croup	Whooping Cough	Diarrhoea	Enteritis	Erysipelas	Puerperal Fever	Phthisis	Other Tubercular Diseases	Bronchitis	Pneumonia	Premature Births	Diseases & Accidents of Partuition	Heart Disease	Accidents	All other Diseases	Total		% All Other Diseases of Total Deaths	% Premature Births of Total Deaths	% Bronchitis, Pneumonia etc of Totall Deaths	% Diarrheaol Deaths of Total Deaths
1900		1				1							1	1	3		1		4	12		33.33	25.00	16.67	0.00
1901							1					2	2		1		1		6	13		46.15	7.69	15.38	7.69
1902												1	3		2				4	10		40.00	20.00	30.00	0.00
1903												2			1				6	9		66.67	11.11	0.00	0.00
1904												1	1						5	7		71.43	0.00	14.29	0.00
1905		1					2						4						8	15		53.33	0.00	26.67	13.33
1906								1							2	1			4	8		50.00	25.00	0.00	1.00
1907						1						1	1	1	3				2	9		22.22	33.33	22.22	0.00
1908						1				2		1	1		4			1	8	18		44.44	22.22	27.78	0.00
1909													1		3				5	9		55.56	33.33	11.11	0.00
1910						1						1			3				3	8		37.50	37.50	0.00	0.00
1911							1						2		6				2	11		18.18	54.55	18.18	9.09

Source: Compiled from County MOH reports held at Leicestershire Area Health Authority bby N A Cattell

APPENDIX 5 Analysis of Death by Cause - Shepshed Urban District

Shepshed Urban (N.B. Under 5 years)	Smallpox	Measles	Scarletina	Diptheria	Croup (not spasmodic)	Whooping Cough	Diarrhoea and Dysentery	Erysipelas	Puerperal Fever	Phthisis	Bronchitis Pneumonia & Pleurisy			Heart Disease	Injuries	All other Diseases	Total	Total Deaths Under 1 Year	% All Other Diseases of Total Deaths	% Premature Births of Total Deaths	% Bronchitis, Pneumonia etc of Total Deaths	% Diarrheaol Deaths of Total Deaths
1890				1	1						2					19	23	15	82.61		8.70	0.00
1891		2		1	1		1				1					22	28	21	78.57		3.57	3.57
1892		4		1							6					18	29	20	62.07		20.69	0.00
1893			2	3		1	3				6				1	20	36	22	55.56		16.67	8.33
1894		1	1								7				1	16	26	20	61.54		26.92	0.00
1895		10		1			1				8				1	21	42	24	50.00		19.05	2.38
1896				1		1	1				3				3	20	29	22	68.97		10.34	3.45
1897							1				5			1		19	26	19	73.08		19.23	3.85
1898				1			2				1					17	21	16	80.95		4.76	9.52
1899			1	1			2				8			1	1	9	23	19	39.13		34.78	8.70

Under 1 Year Deaths Shepshed Urban	Smallpox	Measles	Scarlet Fever	Diptheria & Membranous Croup	Croup	Whooping Cough	Diarrhoea	Erysipelas	Gastritis	Puerperal Fever	Phthisis	Other Tuberlular Diseases	Bronchitis	Pneumonia	Other Diseases of the Respiratory System	Premature Birth	Heart Disease	Accidents	All other Diseases	Total		% All Other Diseases of Total Deaths	% Premature Births of Total Deaths	% Bronchitis, Pneumonia etc of Total Deaths	% Diarrheaol Deaths of Total Deaths
1900		3				6	5					1	8		1	4			6	34		17.65	2.94	23.53	5.00
1901							2				1	5	6			5	1		4	24		16.67	0.00	25.00	2.00
1902						1	1					6	4	2					5	19		26.32	0.00	31.58	1.00
1903							1	3				2	1	1		3	3		4	18		22.22	0.00	11.11	17.67
1904							5	1				1				5			7	19		36.84	0.00	0.00	10.26
1905					1	4	1					1	3	1		3			11	25		44.00	0.00	16.00	1.00
1906							4				1		4	1	2	3			11	26		42.31	7.69	19.23	4.00
1907							2						3			3			7	15		46.67	0.00	20.00	2.00
1908						1	1	2				1	1			5			8	19		42.11	0.00	5.26	11.53
1909							1		2				2			1	1		6	13		46.15	0.00	15.38	1.00
1910						3		1	1				2						9	16		56.25	0.00	12.50	6.25
1911							2					1	1	1		6			5	16		31.25	0.00	12.50	12.50

Source: Compiled from County MOH Reports at Leicestershire Area Health Authority by N A Cattell

APPENDIX 6

In the course of this study, births and infant deaths have been classified according to the occupation of fathers of the children involved. For many occupations the numbers are very small, so there was little point in calculating the IMRs, hence the recourse in this (and many other studies) to a class based analysis. However, these totals, when taken together with those from other areas may make a meaningful analysis possible. For that reason they are given here.

Occupation	SEG	Births	Infant Deaths
Blacksmith	III	163	21
Blacksmiths striker	IV	32	3
Bricklayer	III	394	46
Brickmaker, setter and burner	IV	69	8
Butchers	III	189	13
Pork butchers	III	181	0
Coal merchants and dealers	III	81	12
Colliers and miners	V	208	19
Farmers and graziers	II	226	25
Farm labourers	IV	299	24
Fishmongers and sellers	III	46	3
Framework knitters (fwk)	III	2164	319
Hosiery workers (less fwks)	III	484	52
Labourers	V	3189	560
Licensed victuallers	III	170	28
Beerhouse keepers and brewers	IV	20	2
Stonemasons	III	44	9
Stone quarrymen	V	327	43
Engineering workers	All	2331	307
(includes all machine	III	1984	267
fitters)	IV	325	39
Railway workers	All	542	65
(includes all engine drivers	III	294	36
not specified at other works)	IV	202	24

Source: Vaccination and Infant Death Register data.

Bibliography

Primary Sources

Census Enumerators Books (1891) Loughborough & District 11 Fiches (RG 12/2514-7)

Census Abstract for the county of Leicestershire (1901) (63 Vict. c.4 Table 35a:64)

Directories of Leicestershire: Kelly 1891, 1904; Wright 1892

Land Duty Survey Books (1910) 'Domesday Survey Books' (DE 2072/47-51)

Medical Officer of Health Reports:

CMOH: *Leicester County Medical Officer of Health Reports* 1890-1911. Held at Leicestershire District Health Offices (unreferenced)

LeMOH: *Leicester City Medical Officer of Health Reports* 1874-79

LMOH: *Loughborough Medical Officer of Health Reports* (the years 1908-1911 in the Local History Section at Loughborough Library: various years between 1894-1909 for Loughborough Rural and Urban districts and Shepshed U.D held in the Wellcome Foundation Library London)

Parliamentary Papers:

Lee, W (1849) *Report to the General Board of Health on a Preliminary Inquiry into the Sewerage, Drainage, and supply of Water, and the Sanitary Conditions of the Inhabitants of the Parish of Loughborough.* Public Health Act (11 & 12 Vict., Cap. 63) 10-12 London HMSO

(1872) *First Report of the Local Government Board* XXVIII:77-81

(1912-13) *Forty-Second Annual Report of the Local Government Board* 'Supplement...containing a second report on Infant & Child Mortality' HMSO, London

British Sessional Papers (BSP): House of Commons

Sixth Report of the Rivers Pollution Committee (1874) XXX111:311-464 (Vols XX-XL [MC149])

National Statistics *Annual abstract of statistics* (2004: 55 Table 5.20) London TSO

Poor Law Records:

Loughborough Union Minute Books (1911) (G/7/8a/23:473, DE15/26 & 27)
Loughborough Workhouse Minute Books 1904-1908:17 (G/7/8a/22)

Registrar General's Reports:

The Registration Reports (England) Quarterly & Weekly [Returns of the Registrar-General of the marriages, births and deaths registered in the divisions, counties and districts of England 1850 – 1910] (held at the library of the London School of Hygiene and Tropical Medicine) HM Stationery Office, London

Reports of the Registrar-General of births, deaths and marriages for England and Wales 1907 (MF 2184) 1908-191 (MF 2185)

Registers (Civil):

Vaccination Birth Registers (Loughborough Sub-registration District) (1883-1931) (G/7/154/1-30)
Vaccination Infant Death Registers (Loughborough Sub-registration District) (1887–1916) (G/7/149/1-13)

Local Reports:

Biggs J (1912) *Vaccination versus Sanitation* Leicester Anti-Vaccination League

Buck, W E & Franklin, G C (1875) 'Report on the epidemic diarrhoea of 1875' (Pamphlet Vol 49)

Hodson, G & Hodson, F W (1898) *Report on the extension of the waterworks in the Blackbrook Valley to the Borough of Loughborough* 15th Sept

Moore, C A (1887) *'The Influence of the Geological Features of a District on the Health of its Inhabitants'* Paper given to Leicester Literary and Philosophical Society **1** (Part 2)

Paul, J D, F.G.S. (1885) 'The Valley of the Soar', *Sanitary Institute of Great Britain*, Report for Congress at Leicester on 25 September 1885 (Pamphlet Vol 75)

Sloane, J (1876) *Report to the Sanitary Committee of the Borough of Leicester* (Pamphlet Vol 63:9)

Weaver, R (1871) 'Sanitary Enquiry into the probable causes of yearly epidemics in England, as observed at Leicester' (Pamphlet Vol 47)

Weir, A M (1878) *Infant Mortality and Summer Diarrhoea: their causation and cure, with refutation of the sewer-gas and germ theory* (Pamphlet Vol 33)

Secondary Sources

Unsigned editorials and anonymous articles

Author & date unknown, *Notes on Annual Reports of MOH* (1854-1900)

Maps

Ordnance Survey Pathfinder Map (1994)
Ordnance Survey Geological Survey Map of Great Britain (1950 Sheet 141)

Open University Project Sources

Drake, M and Razzell, P course directors (1997 on) *The decline of Infant Mortality in England & Wales 1871 – 1911: A Medical Conundrum*

Birch, P A (OU 1997) *Factors in the structure and decline of infant mortality in the Ampthill sub-district of Bedfordshire 1873 – 1900* Unpublished BPhil thesis

Cattell, N A ed. (1999) *Vaccination Registers 1871-1910* Data for various areas in England transcribed by post-graduate students for the Open University Infant Mortality Project and produced in CD ROM format Milton Keynes Open University

Drake, M & Razzell, P (OU 1997) *Interim Report on Infant Mortality* Unpublished Paper Open University

Other Published Articles, Monographs and Unpublished Theses

Allen & Hanbury (1913) *Infant Feeding & Management* Manual produced and published by the baby food manufacturers (author's own copy)

Anderson, L J; Parker, R A & Strikas, R L (1990) 'Association between respiratory syncytial virus outbreaks and lower respiratory tract deaths of infants and young children' *Journal of Infectious Disorders* Apr **161** (4) 640-6

Armstrong, D (1986) 'The invention of infant mortality' *Sociology of Health and Illness* **8** 211-232

Armstrong, W A (1972) 'The use of information about occupation' in Wrigley, E. (ed.) *Nineteenth century society: essays in the use of quantitative methods for the study of social data.* Cambridge Cambridge University Press 215-223

Ayres, J G (1986) 'Seasonal pattern of acute bronchitis in general practice in the United Kingdom 1976-83' *Thorax* Feb **41** (2) 106-10

Bayes, T (1763) *Essay toward solving a problem in the doctrine of chances* London: Philosophical Transactions **53** 370-418

Bell, F & Millward, R (1998) 'Public Health Expenditures and mortality in England and Wales, 1870 - 1914' *Continuity and Change* **13** (2) Cambridge, Cambridge University Press 1-29

Botting, B J; Macfarlane, A J & Price F V eds. (1990) *Three, four and more: a study of triplet and higher order births,* Great Britain Office of Population Censuses and Surveys HMSO

Brend Dr W A (1917) 'The relative importance of pre-natal and post-natal conditions as causes of infant mortality', in *The Mortalities of birth, infancy, and childhood,* National Health Insurance Medical Research Committee Special Report Series (10) London HMSO

Browne, J H Balfour (1911a) 'Water Supply' *Chemical News* Vol **CIV** (2709) 206

Browne, J H Balfour (1911b) 'Water Supply' *Chemical News* Vol **CIV** (2710)) 216

Brunekreef, B; Dockery, D W; Speizer, F E; Ware, J H; Spengler, F E & Ferris, B G (1989) 'Home dampness and respiratory morbidity in children' *American review of respiratory disease* Nov **140** (5) 1363-7

Buchanan, Dr (1866) Appendix No 2 'On results of Works, etc, for promoting Public Health' *The Ninth Report of the Medical Officer of the Privy Council* HMSO 70-79

Cook, H W (1934) *Bygone Loughborough* Loughborough publisher unknown

Crowther, H & Reynolds, R (1897) 'A decade of sunshine observations at Leeds' *Journal of the Sanitary Institute* xviiii: 602

Deakin, W A (1979) *The Story of Loughborough 1888-1914* Loughborough Echo Press

Deakin, W A (1974) *19th Century Loughborough, A review of the past century* Loughborough Echo Press

Douglas, A S; Strachan, D P & Maxwell J D (1996) 'Seasonality of tuberculosis: the reverse of other respiratory diseases in the UK' *Thorax* Sep **51** (9) 944-6

Douglas J W (1950) 'The extent of breastfeeding in Great Britain in 1946 with special reference to the health and survival of children.' *The Journal of Obstetrics and Ggynaecology* **57** 335-61

Downing, R A (1998) *Groundwater our hidden asset.* Nottingham, British Geological Survey

Drake, M (In press) 'The vaccination registers: what are they and what can we learn from them?' *Local Population Studies* **74**

Drake, M (2005) *Infant Mortality: Issues, Sources And Findings* unpublished manuscript

Dyhouse, C (1978) 'Working-class Mothers and Infant Mortality in England, 1895-1914' *Journal of Social History* **12** (2) 248-267

Edmonds, T R (1835-6) 'On the Mortality of Infants in England' *The Lancet* **1** 690-4

Elliott, M (1979) *Victorian Leicester* Chichester, Phillimore.

Fildes, V (1998) 'Infant feeding practices and infant mortality in England, 1900-1919' *Continuity and Change* **13** (2) 251-280

Findlay, L (1917) 'The relative importance of pre-natal and post-natal conditions as causes of infant mortality'. in *The Mortalities of birth, infancy, and childhood* National Health Insurance Medical Research Committee Special Report Series (10) London HMSO 37

Flexner, S & Holt, L E (eds.) (1904) *Bacteriological and clinical studies of the diarrheal diseases of infancy from The Rockefeller Institute for Medical Research* New York

Frazer, S M F (1980) 'Leicester and Smallpox: The Leicester Method' *Medical History* **24** 315-332

Galley, C (2004) 'Social intervention and the decline of infant mortality: Birmingham and Sheffield, c.1870-1910' *Local Population Studies 73* 29-49

Galley, C (1993) 'One Face, One Voice, One Heart, and Two Persons!" The Survival of Twins in Early Modern Society' *Local Population Studies* **51** 73-76

Gardarsdottir, O (2002) *Saving the child: regional, cultural and social aspects of infant mortality decline in Iceland, 1770-1920* Umea: Demographic Database

Garrett, E; Reid, A; Schurer, K & Szreter, S (2001) *'Changing family size in England and Wales, place, class and demography in England and Wales, 1891 – 1911'* Cambridge, Cambridge University Press

Garrett, E & Reid, A (1995) 'Thinking of England and taking care: family building strategies and infant mortality in England and Wales, 1891-1911' *International Journal of Population Geography* **1** 69-102

Gelberg, K H *et al* (1999) 'Nitrate Levels in Drinking Water in Rural New York State' *Environmental Research* **20** (1) 34-40 New York Dept of Health

Gray, A M (1990) *Medical Care and Public Health*. Studies in British Social and Economic History Series **54** Oxford University Press

Guha, S (1993) 'Nutrition, Sanitation, Hygiene, and the Likelihood of Death: The British Army in India c.1870-1920' *Population Studies* **47** 385-401

Haines, M R (1995) 'Socio-economic Differentials in Infant and Child Mortality during Mortality Decline: England and Wales, 1890-1911' *Population Studies* **49** 297-315

Howe, G M (1976) *Man, Environment and Disease in Britain*, Pelican Geography & Environmental Studies (series ed. Peter Hall) Penguin Books

Huck, P (1997) 'Shifts in the Seasonality of Infant Deaths in Nine English Towns during the 19th Century: A Case for Reduced Breast Feeding?' *Explorations in Economic History* **34** 368-386

Humphries, S & Gordon, P (1993) *A Labour of Love. The Experience of Parenthood in Britain 1900-1950* London Sidgwick & Jackson

Jones, Dr H (1894) 'The Perils and Protection of Infant Life' *Journal of Royal Statistical Society* **57** March 1-98

Koskinen, O M; Husman, T N; Meklin, T M & Nevalainen, A I (1999) 'The relationship between moisture or mould observations in houses and the state of health of their occupants.' *European Respiratory Journal* Dec **14** (6) 1363-7

Landers, J (1993) *Death and the metropolis: studies in the demographic history of London, 1670-1830* Cambridge, Cambridge University Press

Langer, W L (1974) 'Infanticide: A Historical Survey' *History of Childhood Quarterly* **1** 353-365

Langford, I H & Bentham, G (1995) 'The potential effects of climate change on winter mortality in England and Wales' *International Journal of Biometeorology* Mar **38** (3) 141-7

Lee, C H (1991) 'Regional inequalities in infant mortality in Britain 1861-1971. Patterns and hypotheses' *Population Studies* **45** 55-65

Levine, D (1974) *The demographic implications of rural industrialization, a family reconstitution study of two Leicestershire villages 1600-1851* Cambridge unpublished PhD dissertation

McCleary, G F (1905) *Infantile Mortality and Infant Milk Depots* London P S King & Son

McKeown, T (1976) *The Modern Rise of Population* London Edward Arnold

McKeown, T & Record R G (1962) 'Reasons for the Decline of Mortality in England and Wales during the Nineteenth Century *Population Studies* **16** 94-122

Matthews, R (1998) 'Flukes and flaws' *Prospect* 20-24 November

Millard, C K; M.D., D.Sc. (1911) *Leicester MOH Report* (L614)

Mooney, G (1994a) *The geography of mortality decline in Victorian London* Unpublished PhD Thesis Liverpool University

Mooney, G (1994b) 'Still-births and the measurement of urban infant mortality rates c.1890-1930' *Local Population Studies* **53** 42-52

Mooney, G; Luckin, W & Tanner, A 'Patient Pathways: solving the problem of institutional mortality in London during the later 19th century (1999) *Social History of Medicine* 12 (2) 227-269

Munro, L J A; Penning-Rowsell, E C; Barnes, H R & Herring, M (1997) *Infant Mortality and Soil Type: a case study in south-central England* (with discussion) European Journal of Soil Science, March 1997 48 1-17

Murphy, B; Phelan P D; Jack, I & Uren E (1980) 'Seasonal pattern in childhood viral lower respiratory tract infections in Melbourne' *Medical Journal of Australia* Jan 12 1 (1) 22-4

Newman, G (1906) *Infant Mortality. A Social Problem.* London, Methuen & Co.

Newsholme, A (1906) 'A domestic infection in relating to epidemic diarrhoea' *Journal of Hygiene* 6 139-148

Newsholme, A (1899) 'The Study of Epidemic Diarrhoea' Presidential Address to the Incorporated Society of Medical Officers of Health of November 1899 in *Public Health*, 12 (3) 139-213

Nichols, J (1804) *History and Antiquities of the County of Leicester* 3 (2) 884-918

Niven, J (1903) *Manchester Annual Health Report* Manchester

Nolan, G M (1982) *Infant Mortality as an indicator of environmental and social change, 1890-1939 with special reference to Derby* unpublished PhD thesis Nottingham University

Peters, O H (1910) 'Observations upon the natural history of epidemic diarrhoea' *Journal of Hygiene* 10 602-777

Pick, S P County Engineer (1914) *River Soar Floods*, Leicestershire County Council Plan No.2, No. 9381 5 January 1914 (DE754/4)

Pooler, Dr H W (1918) 'Infant mortality and education of the mother' *The Lancet* 6 July 1918:3-7

Priestley, C (1955) *Trials & tribulations of a local board of health: Loughborough 1850-1888* (L614)

Preston, S H & Haines, M R (1991) F*atal Years: Child Mortality in Late Nineteenth-Century America* Princetown NJ: Princeton University Press

Pye, N ed. (1972) *Leicester and its Regions*. Leicester University Press for the Local Committee of the British Association

Reid, C ed. (1990) *Atlas of the Borough of Charnwood* 3rd edition Dept. of Geography Loughborough University of Technology

Richardson, L (1931) *'Wells and Springs of Leicestershire'*. Department of Scientific and Industrial Research Geological Survey of Great Britain HMSO

Royle, S A (1981) *Functional Divergence: Urban Development in Eighteenth and Nineteenth Century Leicestershire* Leicester University Geography Department Occasional Paper 3

Russell, C (1996) 'The analysis of water supply' *Edward Frankland Chemistry, Controversy and Conspiracy in Victorian England* (Chapter 13) Cambridge Cambridge University Press

Schofield, R S (1998): *Parish register aggregate analyses: the population history of England database and introductory guide* Local Population Studies Colchester

Smith, F B (1979) *The People's Health 1830-1910*, London, Croom Helm.

Strachan, Dr A J, compiler (1986) *Atlas of Leicestershire*, 2nd Ed. Section 4.1 Community and Employment Research Unit Department of Geography University of Leicester

Szreter, S R S (1984) 'The genesis of the Registrar-General's social classification' *British Journal of Sociology* **35** (4) 523-546

Szreter, S R S (1988) 'The importance of social intervention in Britain's mortality decline c.1850-1914: a re-interpretation of the role of public health' *Social History of Medicine* **1** 1-37

Terrero, C; Demorizi, J A; Feris, J M; Morillo, E & Pozo, C (1992) 'Incidence of measles with complications' *Archivos dominicanos de pediatria,* May-Dec **28** (2-3) 31-4

Thompson, P (1992) *The Edwardians. The Remaking of British Society.* 2nd Ed., Routledge, London and New York

Titmuss, R M (1943) *Birth, poverty and wealth: a study of Infant Mortality* London, Hamish Hamilton Medical Books Appendix C

Watterson, P A (1988) 'Infant mortality by father's occupation from the 1911 census of England and Wales' *Demography* **25** (2) May 289-306

Williams, N J (1994) 'The implementation of compulsory health legislation; infant smallpox vaccination in England and Wales' *The Journal of Historical Geography,* **20** (4) 396-412

Williams, N (1992) 'Death in its Season: Class, Environment and the Mortality of Infants in Nineteenth-century Sheffield' *The Society for the Social History of Medicine* **5** (1) 71-94

Williams, N (1989) *'Infant & Child Mortality in Urban Areas of Nineteenth-Century England and Wales: A Record-linkage study'* PhD thesis University of Liverpool

Williams, N & Galley, C (1995) 'Urban-rural differentials in infant mortality in Victorian England' in *Population Studies* **49** 401-420

Wohl, A S (1983) *Endangered Lives: Public Health in Victorian Britain* London J M Dent & Sons Ltd 279-84

Woods, R (2000) *The Demography of Victorian England and Wales* Cambridge, Cambridge University Press (Cambridge Studies in Population, Economy and Society in Past Time series)

Woods, R I (1995) SN3552 *Causes of Death in England and Wales 1851-60 to 1891-1900: The Decennial Supplements* [Computer File] Colchester, Essex CO4 3SQ The Data Archive University of Essex

Woods, R & Shelton, N (1997) *An Atlas of Victorian Mortality* Liverpool, Liverpool University Press

Woods, R I; Watterson, P A & Woodward J H (1989) 'The causes of rapid infant mortality decline in England and Wales 1861 – 1921 Part II *Population Studies* **43** 113-132

Woods, R I; Watterson P A & Woodward J H (1988) 'The causes of rapid infant mortality decline in England and Wales 1861 – 1921 Part I *Population Studies* **42** 343-36

Woods, R; Williams, N & Galley, C (1993) 'Infant mortality in England 1550-1950 Problems in the identification of long-term trends and geographical and social variations' in Corsini, C A & Viazzo, P P eds. *The decline of infant mortality in Europe 1800 – 1950. Four national case studies* Florence Unicef Instituto degli innocenti di firenze 35-50

Woodwark, S (1938) 'The rise and fall of certain disease conditions currently with the progress of hygiene and sanitation' *Journal of the Royal Institute of Public Health and Hygiene* **1** 897-910

Wrigley, E A; Davis, R S; Oeppen, J E & Schofield, R S, (1997) *English population history from family reconstitution 1580-1837* Cambridge Cambridge University Press